NATUR CYMRU
Nature of Wales

Number/Rhif 59 • Summer/Haf 2016

- Rothschild's reserves
- Strandline beetles
- Pembrokeshire islands
- Earthstars
- Trelogan
- Ffair Bioamrywiaeth Eryri
- Freshwater pearl mussels

Books, news, comment ...

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NATUR CYMRU CYNNWYS • CONTENTS

Golygyddol / Editorial • David Parker 3

The Welsh Rothschilds - identifying places for nature • Jonathan Mullard ..... 4 - 9
It is 100 years since Charles Rothschild selected his proposed nature reserves in Wales

The end of the line for the Strandline Beetle? • Mike Howe ..... 10 - 13
Many environmental factors could be driving this rare beetle to extinction

Earthstar fungus *Geastrum britannicum*: coming soon to a churchyard near you • Andrew Shaw .... 14 - 17
A new species, which only occurs in Britain, has been found in a number of Welsh churchyards

Trelogan - a small Welsh village with a worldwide reputation • Paul Day and Phil Putwain ..... 18 - 23
How lead mining has led both to rare plants and to the study of evolution in action

A photographer's journey - from landscapes to birds in their habitat • Jeremy Moore ..... 24 - 28
A personal account of how bird photography grew out of a love of landscapes

Eryri - mwy na mynyddoedd • Gethin Davies ..... 29 - 31
Taith Bioamrywiaeth Flynyddol o amgylch ysgolion Eryri

Do bats visit the Pembrokeshire Islands? • Rachel Taylor ..... 32 - 35
New technology is revealing a great deal about hitherto unknown movements of bats

"I had seen nothing in nature so spectacular" The Grassholm Saga • David Saunders ..... 36 - 40
The long and colourful history of this Pembrokeshire island

Freshwater pearl mussels - Pearls in Peril • Elain Gwilym and Jackie Webley ..... 41 - 43
A four year project is now nearing completion with hope for the future of this iconic species

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NODWEDDION ARFEROL / REGULAR FEATURES

Green Bookshelf • James Robertson, Mike Howe ..... 43 - 44

Marine Matters • Ivor Rees 46
'Seared Scallops' - the implications of proposed scallop dredging in the Cardigan Bay SAC

Buglife • Ryan Clark 47
There is life in dead wood!

From the Garden • Bruce Langridge 48
Dancing to the rhythm of fungi – ballerina waxcaps

Discoveries in science • Harriet Wood 49
Safeguarding the gems of a scientific collection

Plantlife • Colin Cheesman ..... 50 - 51
Great Orme - its botanical riches and management challenges

Woods and forests • Nick Atkinson 52
The Long Forest - hedgerows and their management

GOLYGYDDOL

Sefydlwyd cyfnodolyn *Natur Cymru* yn 2001 yn gofnod o fywyd gwyllt ac amgylchedd naturiol Cymru, gan gydnabod pwysigrwydd y cofnod ysgrifenedig er mwyn gwella'n gwybodaeth, ein dealltwriaeth a'n gallu i wneud penderfyniadau. Fe wŷr darllenwyr bod y cymorth i *Natur Cymru* gan Gyfoeth Naturiol Cymru (a'i sefydliadau blaenorol), a gydnabyddir gyda diolch, yn dod i ben wedi'r rhifyn cyfredol hwn. Mae Cyfarwyddwyr *Natur Cymru* felly'n chwilio am ffynonellau newydd o gyllid er mwyn mynd â'r cylchgrawn yn ei flaen.

Gwyddom o'n harolwg darllenwyr bod galw mawr yn dal i fod am *Natur Cymru* ac y byddai bwlch sylweddol pe bai'n peidio â bod. Mae'r arian gennym i gyhoeddi'r rhifyn nesaf (rhif. 60) yn yr hydref ac rydym wedi bod yn codi arian i fynd â'r cylchgrawn ymlaen i 2017. Erbyn i chi dderbyn y rhifyn hwn o *Natur Cymru* bydd ein hapêl codi arian wedi dod i ben. Diolch i nifer ohonoch am eich addewidion a'ch cymorth ariannol uniongyrchol yn ogystal â'ch negeseuon ysgrifenedig o gefnogaeth. Mae'n ddiddorol faint o'r rhain sydd wedi dod o'r tu allan i Gymru, sy'n adlewyrchu rôl lysgenhadol *Natur Cymru* yn hyrwyddo cyfoeth mawr bioamrywiaeth Cymru. Bydd eich cefnogaeth yn rhoi'r cyfle i ni chwilio am a sicrhau'r gefnogaeth ariannol a'r gwirfoddolwyr hirdymor angenrheidiol er mwyn sicrhau dyfodol cynaliadwy ar gyfer y cylchgrawn.

Mae'r rhifyn hwn o *Natur Cymru* yn cynnwys yr ystod eang arferol o erthyglau gyda rhywfaint o thema hanesyddol. Mae'r erthyglau ar Warchodfeydd Rothschild yng Nghymru yn dangos ein bod wedi bod yn eithaf llwyddiannus yn gofalu am y prif safleoedd bywyd gwyllt a gydnabuwyd gan Charles Rothschild yn gynnar yn yr 20fed ganrif, tra bod gan ynys adar Gwales yn Sir Benfro hanes hynod ddiddorol - o safbwynt dyn ac aderyn. Mae tomenni gwastraff cloddfeydd plwm Trelogan yn Sir y Fflint yn ganlyniad hanes hir o fwyngloddio ond maent wedi darparu labordy awyr agored ar gyfer nifer o astudiaethau diddorol ar blanhigion metel-oddefgar a brofodd i fod yn un o'r enghreifftiau gorau yn y byd o esblygiad drwy ddetholiad naturiol.

Mae'r erthygl ar gadwraeth Misglen Berlog yr Afon yn dod â'r stori yn ei blaen 15 mlynedd. Ysgrifennodd Graham Oliver am y rhywogaeth hon, a'i ofn ei bod yn dirywio'n derfynol, yn rhifyn cyntaf *Natur Cymru*. Roedd yn dadlau ei bod, fel purwr dŵr naturiol, yn haeddu proffil llawer uwch a mwy o ofal. Mae'r rhagolygon ar gyfer y Fisglen Berlog bellach lawer yn fwy addawol a gallu *Natur Cymru* i adrodd a dathlu llwyddiannau fel hyn sy'n ei gwneud yn hollbwysig bod y cyfnodolyn hwn yn goroesi.

David Parker

Early summer on the Isle of Anglesey coastal path between Dulas and Point Lynas

EDITORIAL

Natur Cymru was established in 2001 as a journal of record about the wildlife and natural environment of Wales, recognising the importance of the written record to improve our knowledge, understanding and decision-making. Readers will know that the support *Natur Cymru* has had from Natural Resources Wales (and its predecessor organisations), which we acknowledge, with thanks, ceases from this current edition. *Natur Cymru* Directors are now actively seeking new sources of funding to take the magazine forward.

We know from our reader survey that there is still a great demand for *Natur Cymru* and there would be a significant gap if it were to cease to exist. We have the funds to publish the next edition (no. 60) in the autumn and we have been raising funds to take the magazine forward into 2017. By the time you receive this edition of *Natur Cymru* our fundraising appeal will have come to an end. Thanks to many of you for your pledges and direct financial help as well as your written messages of support. It is interesting how many of these have come from outside Wales, reflecting the ambassadorial role *Natur Cymru* has in promoting the great wealth of Welsh biodiversity. Your support will give us time to seek and secure the necessary long-term financial and volunteer support to ensure a sustainable future for the magazine.

This edition of *Natur Cymru* contains the usual wide range of articles with something of a historical theme. The articles on Rothschild's Reserves in Wales shows that we have been quite successful at looking after the top wildlife sites recognised by Charles Rothschild in the early 20th century, whilst the bird island of Grassholm in Pembrokeshire has a fascinating history of both human and bird colonisation. The lead-mine waste tips at Trelogan in Flintshire are the result of a long history of mining but they formed the outdoor laboratory for some fascinating studies on metal-tolerant plants which proved to be one of the best examples in the world to demonstrate evolution by natural selection.

The article on the conservation of Freshwater Pearl Mussel takes the story forward 15 years. Graham Oliver wrote about this species, which he feared was in terminal decline, in the first edition of *Natur Cymru*. He argued that it deserved a much higher profile and greater care, as nature's water purifier. The outlook for the Pearl Mussel is now brighter and it is the ability of *Natur Cymru* to report and celebrate achievements like this that makes it so important that this journal of record survives.

David Parker

All photos: Jonathan Mullard

The Welsh Rothschilds - identifying places for nature

Stanner Rocks, Radnorshire

In 1915 Charles Rothschild produced the first list of places worthy of preservation for nature. Although the information about the Welsh sites selected was sketchy, it is instructive to revisit the list and consider how they have fared, and, as author JONATHAN MULLARD points out, to consider in what condition they may be in when another century has passed.

Growing up in rural Shropshire with an interest in natural history, I was often tempted by advertisements for the latest microscope, or even a proper butterfly net, rather than having to use shrimping nets acquired on rare trips to the seaside. Requests to my parents for the necessary funds, however, were often met by the response "We're not Rothschild". So the name entered my consciousness as a source of untold wealth, which would enable these desirable items to be obtained immediately, rather than having to slowly save up for them. It was only much later, on securing a job with what was then the Glamorgan Naturalists' Trust, that I realised that there was another, and perhaps richer, legacy from the Rothschild family. A legacy which endures today.

It began with Charles Rothschild, the second son of Baron Rothschild. Although he worked at the family bank, and apparently never missed a day in the office, he was passionately interested in natural history. Rothschild published his first scientific paper on the moths and butterflies of Harrow while still at school and in 1899 established the

UK's first nature reserve, at Wicken Fen in Cambridgeshire. Donating the site to the National Trust in 1901 he specified that it should be managed as a nature reserve, with the conservation of the swallowtail butterfly *Papilio machaon* as a key objective. Although only 22 years old, Rothschild had already decided that there was a need to manage and protect what he termed 'good spots'. The aim was to secure permanent havens for wildlife protected from the intrusions of the 20th century. In May 1912 he therefore organised a meeting to discuss his radical idea that wildlife-rich habitats should be preserved. This led to the formation of the Society for the Promotion of Nature Reserves (SPNR), which would eventually become the Royal Society of Wildlife Trusts. The creation of the Society was, however, a last, not a first, resort since Rothschild hoped that the National Trust would "take nature under its wing". In the event, apart from Wicken Fen and a few other sites, it didn't properly engage with wildlife for many years[1].

First surveys

Following the creation of the SPNR, questionnaires enquiring about potential nature reserves were sent to landowners and natural history societies across the UK. Occasionally the Society also carried out its own surveys. George Claridge Druce, the famous Oxford botanist, and SPNR council member, was one of the key activists. Among the sites he visited, and proposed to the Society, was Craig Breidden. Although now disfigured by a huge quarry, this volcanic hill on the border between Shropshire and Montgomeryshire is well known for its rare flora and the unusual mix of calcicolous and calcifugous plants that can be found on the cliff ledges. The rarities here include rock cinquefoil *Potentilla rupestris*, spiked speedwell *Veronica spicata* (the 'county flower' of Montgomeryshire), shaggy mouse-ear hawkweed *Pilosella peleteriana* and three species of

Radnor lily *Gagea bohemica* Seren-Fethlehem gynnar

whitebeam, including Stirton's whitebeam *Sorbus stirtoniana*, which is unique to the hill. Similarly Stanner Rocks, another prominent outcrop with rare plants, was also well known to naturalists. It was not until the 1970s, though, that a local botanist, Ray Woods, discovered Radnor lily *Gagea bohemica* here at its only UK site. Through the work of Rothschild, Druce and others, a total of 284 potential nature reserves, scattered across England, Ireland, Scotland and Wales, were identified as being 'worthy of preservation'. The completed forms and associated correspondence were stored in the blue envelopes of Rothschild's Bank – one envelope for each site. The archive was digitised by the Wildlife Trusts as part of their centenary celebrations in 2012 and is now available on their website[2].

Since the National Trust at the time was not interested in taking the lead, the SPNR sought Government protection for the areas that they had identified, but the outbreak of the First World War was a huge setback. Illness too was a factor. Between 1915 and 1926 there was a worldwide epidemic of encephalitis lethargica. The disease attacks the brain, leaving people speechless and immobile. Rothschild was unfortunately one of the victims, eventually committing suicide in 1923. This left the fledgling movement without a leader at a critical time. It was not until after another world war that nature conservation in the UK was formalised

South Stack, Isle of Anglesey

by the National Parks and Access to the Countryside Act of 1949. Many of the 'Rothschild Reserves' are now designated as Sites of Special Scientific Interest or National Nature Reserves, being owned and managed by a range of conservation organisations – including the National Trust. A brief summary of each of the Welsh sites is provided in the table.

There have been three publications about the list. The first by Miriam Rothschild (Charles's eldest daughter) and Peter Marren was published in 1997 as *Rothschild's Reserves, Time and Fragile Nature*. This only covered the 182 sites in England, where Miriam's interests were, and time for further research was short[3]. Their survey found that only 19 English sites had suffered little or no habitat loss, with 21 totally lost. The remainder had been affected not by urban development, as Rothschild feared, but by a progression towards climax vegetation. Many were open habitats maintained by grazing livestock and rabbits but myxomatosis in the 1950s and a reduction in traditional grazing practices changed the picture completely. The second publication, *The Rothschild Reserves in Ireland: 1914-2014*, a free download from the Carnegie UK Trust website, looked at the fate of the 17 sites in the Republic of Ireland put forward in 1914. The third volume, *Prophet and Loss* by Simon Barnes, was published as an e-book in 2015, to mark the centenary of the Rothschild list. This short book, available for £1.00 from the Wildlife Trusts website, just covered seven sites across the UK.

Of the 21 Welsh sites Barnes only visited one, Kenfig National Nature Reserve, providing a critical review of the current state of visitor facilities before becoming captivated by the reserve itself:

"Here I could experience a different kind of neglect: the benign kind. There are many places in Britain and the world that will stay fabulous so long as we humans do absolutely nothing whatsoever. You'd have thought doing nothing was an easy option, but it seldom turns out that way. So here was something special."

As indicated above, although Rothschild's work was pioneering, it was not a comprehensive survey, relying as it did on the enthusiasms and knowledge of a number of local contacts. The inclusion of Kenfig, for example, came about as a result of a letter from Mr R J Randall, a prominent resident of Bridgend. He wrote to the SPNR after seeing an article on the formation of the Society in *The Times* newspaper on 18 December 1912 suggesting that "there are several areas in this county (Glamorgan) which would be admirably suited for the purpose", including Worms Head at the western tip of Gower. Elected as a member of the Society the following March, he confirmed that the tidal island was already designated under the Wild Birds Protection Act and went on to suggest that "there are some large areas of sand dunes near here which are perfectly useless for any agricultural purpose and under the present owners ... they are practically treated as nature reserves. The partridges and rabbits are shot and the wild geese are shot once or twice a year during their annual visit but otherwise all the wildlife is preserved." The dune systems Randall was referring to were Merthyr Mawr Dunes and Kenfig Dunes, both now designated as National Nature Reserves. For some reason only Kenfig made it onto Rothschild's list.

Welsh sites

Most of the suggested reserves are, however, in North Wales where the 12 examples cover everything from a site near the summit of Snowdon (Clogwyn), noted for its rare plants such as Snowdon lily *Gagea serotina*, to Puffin Island, off the Anglesey coast. Indeed the Welsh Rothschilds are overwhelmingly coastal, with 11 of the 21 locations

on the list in this category. In addition to Puffin Island there is the nearby Great Orme, named after the Old Norse meaning 'worm' or 'sea serpent', along with its southern companion Worms Head. The two serpents are joined by islands such as Llanddwyn, a tidal island adjoining Newborough Warren, and the Skerries off the Anglesey coast, known as a breeding site for Arctic terns *Sterna paradisaea*, common terns *Sterna hirundo* and, occasionally, roseate terns *Sterna dougallii*. Porth Dafarch and adjacent sea cliffs near Holyhead was regarded as 'primeval country'. The area was valued since it was the only known site in Wales, and indeed the world, for spathulate fleawort *Tephroseris integrifolia ssp maritima*. A subspecies of the field fleawort, it is often called South Stack fleawort since it is endemic to that part of Holyhead Island. Nearby Holyhead Mountain was proposed for its population of spotted rockrose *Tuberaria guttata*. Said to occur there on "3 or 4 acres" it now grows over a much larger area than the listing suggests, so it seems to have spread in the intervening years. Back in the vicinity of the Great Orme, Llandudno Sand Hills was also proposed by the Llandudno and District Field Club for its scarce plants but unfortunately the club neglected to list them. We can therefore only guess what the particular interest was on this site. We can only guess what the particular interest was on this site. One rare moth, the belted beauty *Lycia zonaria,* had its last Welsh location on the Sandhills and is now extinct. A highly localised species, it is particularly susceptible to changes in its habitat. The absence of the massive, and now well-studied, dune system at Morfa Harlech nevertheless is another measure of the random approach to site selection.

Upland sites, apart from Clogwyn, include Craig y Cilau in the Brecon Beacons. This imposing limestone escarpment outcrops along the north eastern edge of Mynydd Llangatwg, creating one of the largest upland limestone cliffs in South Wales. Due to the presence of the limestone and limited grazing, and because of the steep and inaccessible nature of the rock faces, the cliffs support many scarce plants, with at least 250 species recorded. These include angular Solomon's seal *Polygonatum odoratum*, mountain melick *Melica nutans*, hutchinsia *Hornungia petraea* and the most southerly British population of alpine enchanter's nightshade *Circaea alpina*[4]. Cwm / Llyn Idwal in North Wales, the first Welsh National Nature Reserve, is also on the list. Rare arctic-alpine plants, including species such as moss campion *Silene acaulis*, Snowdon lily, and purple saxifrage *Saxifraga oppositifolia*, made it a natural candidate for inclusion.

Sychnant Pass, a site near Conwy, was proposed as 'a breeding place for scarce insects'. An area of heath, acid grassland and bracken within Snowdonia National Park, it is known for its rare moths including two North Wales specialists: Ashworth's rustic *Xestia ashworthii* and Weaver's wave *Idaea contiguaria*. Both are very localised, occurring only in mountainous areas, where they can be found in daylight hours resting on rocks and walls.

Untamed nature?

Surprisingly, only two substantial wetland sites are included in the list: the renowned Cors Caron / Tregaron Bog, described by Natural Resources Wales as an "untamed mix of raised bog, reedbed, wet grassland, ponds, streams and patches of woodland" and Llyn Llywenan, the largest natural lake on

Worm's Head, Gower

Craig y Ciliau, Brecon Beacons

Anglesey. Perhaps 'untamed' is the 21st century version of 'primeval'? Cors Caron is, however, not as unspoiled a site as it might first appear. Peat from here was a vital fuel for local communities until the middle of the 20th century and evidence of old peat cuttings is everywhere. Llyn Llywenan hosts a number of rare and uncommon species such as eight-stamened waterwort *Elatine hydropiper*, spring quillwort *Isoetes echinospora*, and needle spike-rush *Eleocharis acicularis*, which grow on the more exposed sections of the shoreline. Boughrood, on the upper Wye near Llyswen, was proposed for its 'saltings' and plants, including wild chives *Allium schoenoprasum*.

The proposed reserves may have been an arbitrary sample but in terms of the habitats to be found in Wales there are some notable omissions. Strikingly there are no woodland sites on the list. The classic Atlantic oakwoods in West Wales are a major habitat distinguished by the richness of the bryophytes, lichens and ferns that occur there. These temperate rainforests support abundant populations of mosses such as greater fork-moss *Dicranum majus* and lanky moss *Rhytidiadelphus loreus* and liverworts, such as white earwort *Diplophyllum albicans*. Today it is a puzzle why they were not considered. Lowland heathlands and grasslands are also absent from the list, but this is perhaps not unexpected as they would not have been regarded as primeval, even though at the time the list was being compiled they were undoubtedly much richer in wildlife than they are today. That said, agricultural land was inevitably included in the English list, so perhaps there was just a different focus in 'Wild Wales'?

It was certainly the case in Ireland where the report noted that "the SPNR sites are perhaps not altogether representative of important present day landscapes and wildlife habitats..." The main focus of the list being the "bogs, salt marshes, shingle beaches and sand dunes [which] were the most characteristic types of wild country in Ireland."[5]

Unlike the Rothschild Reserves in England it is clear from this brief survey that since 1912 we have not lost any of the Welsh sites. All but one, Llandudno Sand Hills, have a conservation designation, and part of that site was used as a golf course at the time they were listed. So, outwardly at least, they have all remained intact. Unfortunately it is not possible, due to the brief, and sometimes non-existent, descriptions provided to the SPNR by their correspondents, to analyse if there have been changes in the quality of these sites. Where particular species such as Snowdon lily are mentioned, they are still to be found in the same haunts, but changes in populations since 1912 are unknown.

The question we should perhaps ask ourselves instead is what condition the Rothschild Reserves in Wales will be in when another 100 or so years have passed? And, in the face of global climatic change, is there anything we can do to maintain these special areas which Rothschild went to so much effort to record?

Jonathan Mullard *is a regular contributor to* Natur Cymru *and the author of* Gower *and* Brecon Beacons *in the Collins New Naturalist series. He is currently working on a third volume, covering Pembrokeshire, which is due for publication in 2018.*

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Rothschild's Reserves in Wales

Original Site Name	Reason for listing	Current Status
Aberffraw	Coastal site in Anglesey, selected for its sand dunes and rare plants.	Site of Special Scientific Interest and Special Area of Conservation
Boughrood	A site on the Wye proposed for saltings and plants, including the rock cinquefoil.	Site of Special Scientific Interest and Special Area of Conservation
Clogwyn	A site near the summit of Snowdon, proposed to the Society for its scarce plants.	Site of Special Scientific Interest and Special Area of Conservation
Craig Breidden	Proposed for the unusual mix of calcicolous and calcifugous plants on the cliffs.	Site of Special Scientific Interest
Craig-y-Cilau	One of the largest upland limestone cliffs in Wales with a characteristic flora.	National Nature Reserve
Great Orme's Head	A limestone headland on the Creuddyn Peninsula next to Llandudno. Only locality for endemic cotoneaster.	Site of Special Scientific Interest and Special Area of Conservation
Holyhead Mountain	A site near South Stack Lighthouse proposed for its scarce plants, including a species of rock-rose.	Site of Special Scientific Interest. RSPB Reserve.
Kenfig	Proposed to the Society for its sand dunes.	National Nature Reserve
Kidwelly	Proposed to the Society for its sand dunes.	Site of Special Scientific Interest. Pembrey Country Park
Llanddwyn Island	Tidal island adjoining Newborough Warren. Recommended as a breeding place for scarce creatures, primarily birds.	Part of National Nature Reserve
Llandudno Sand Hills	Proposed by the Llandudno and District Field Club for its scarce plants and sea bird populations. Partly used as a golf course.	No designation
Llyn Idwal	A small lake lying within Cwm Idwal. Proposed for its rare plant life.	National Nature Reserve
Porth Dafarch	Noted as primeval country. Proposed as a locality for scarce plants and only site for spathulate fleawort.	Site of Special Scientific Interest
Presaddfed Lake	Known as Llyn Llywenan, the largest natural lake on Anglesey is host to rare aquatic plants and overwintering wildfowl.	Site of Special Scientific Interest. RSPB Reserve.
Puffin Island	Considered as 'worthy of preservation' for its breeding seabirds.	Site of Special Scientific Interest. Special Protection Area for wild birds
Stanner Rocks	Proposed to the Society as an area containing several rare species of plant.	National Nature Reserve
The Skerries	Proposed as worthy of preservation because they were a nesting place for seabirds.	Special Protection Area for wild birds. RSPB Nature Reserve
Sully Island	Proposed as a breeding place for scarce creatures, primarily birds.	Site of Special Scientific Interest
Sychnant Pass	Proposed as a breeding place for scarce insects.	Site of Special Scientific Interest
Tregaron Bog	Proposed as a breeding place for scarce creatures and plants.	National Nature Reserve, Special Area of Conservation and Ramsar site.
Worm's Head	Proposed primarily for its breeding birds.	National Nature Reserve

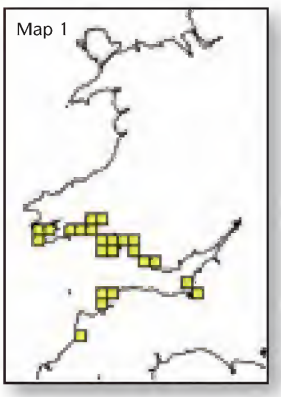
Gwarchodfeydd Rothschild yng Nghymru

Roedd gan Charles Rothschild ddiddordeb angerddol mewn bywyd gwyllt. Sefydlodd warchodfa natur gyntaf y DU yn 1899 ac roedd yn un o aelodau gwreiddiol yr hyn a ddatblygodd i fod yn Gymdeithas Frenhinol yr Ymddiriedolaethau Bywyd Gwyllt. Mae'n dal yn bosibl gweld canlyniad ei waith caled a'i ymroddiad. Bellach mae llawer o 'Warchodfeydd Rothschild' wedi eu dynodi'n Safleoedd o Ddiddordeb Gwyddonol Arbennig neu'n Warchodfeydd Natur Cenedlaethol, ac mae 21 ohonynt yng Nghymru.

The end of the line for the Strandline Beetle?

With its perfect camouflage you could be excused for not spotting the Strandline Beetle. Sadly, there are more sinister reasons why it's rarely seen. MIKE HOWE reports on the decline in populations on the coasts of south Wales.

The Strandline Beetle or Beachcomber *Eurynebria complanata* is one of the UK's most distinctive and attractive ground beetles. With the exception of somewhat questionable records from Lincolnshire (pre-1887 without a voucher specimen[1]] and from Barmouth in Meirionnydd in 1913[2], the beetle has been restricted to coastal sites around the Severn Estuary and Bristol Channel. Map 1 shows the distribution of records by 10 km squares from Somerset to north Cornwall in England and from Glamorgan to Pembrokeshire in Wales. In the same maritime region there are a few records in the south-east corner of Ireland. It has been suggested that the beetle has a Lusitanian distribution along the Atlantic coasts of Spain, Portugal and France[3], with additional records from Finisterre and Herm[4]. It is also known from the Mediterranean coasts including Corsica,



Sardinia, Italy, Sicily, Malta, Algeria, Tunisia and Morocco.

Recently classified as Endangered in the UK[2], the only post-1990 records of Strandline Beetle in England are from Berrow Dunes in Somerset and Braunton Burrows in Devon. It was last recorded at Berrow in 1994 and may have become extinct following beach-cleaning operations[2], and has not been found at Braunton since June 2002. The beetle has not been recorded in south-east Ireland since 2006, but this may be an artefact of survey effort rather than a definite loss[5].

Ecology

Much of our knowledge of the biology and ecology of the Strandline Beetle is the result of studies undertaken at Nicholaston Burrows on Gower between 1964 and 1968[4, 6]. It is primarily associated with strandlines on sandy beaches backed by coastal dunes. Adults are nocturnal and feed predominantly upon sand hoppers (Talitrid Amphipods), although beetle and fly larvae may also be eaten. During the day, they shelter under large debris such as driftwood and artificial flotsam within 3 to 15m of the dune frontage. Gibbs[7] recorded a recent preference for plastic drums and plastic fishing crates.

Adults emerge at the end of May and can be found in most months until January, although peak numbers occur in June and August to September. Mating has been observed from early September to late November, with females laying eggs singly in holes up to 3mm in depth in the sand above the strandline. Larvae begin to emerge in October and can be found until the following March. It is likely that most beetles overwinter as larvae or pupae, with a small proportion overwintering as adults. Although overwintering sites are unknown, it has been suggested that adults (or perhaps larvae) move inland into dune areas during the winter months[8]. If this is the case, then steep frontal dune faces on actively eroding dunes may prove to be a significant barrier to successful dispersal.

Welsh status

In Wales, the Strandline Beetle has been recorded from 14 dune systems, from Merthyr Mawr Warren near Porthcawl to Brownslade & Linney Burrows on the Castlemartin peninsula (Table 1). However, the

Table 1. Dune systems in Wales which have supported the Strandline Beetle. The maximum count ever recorded on the site is given (where available), with the year of the record in brackets. Sites with 2015 records are **highlighted in blue**.

Dune system	Vice-county	Grid Reference	Max. count (year)	Year of last record
Merthyr Mawr Warren	41	SS8576	56 (1995)	2002
Kenfig Burrows	41	SS7881		1996
Crymlyn Burrows	41	SS7092	80 (pre-1861)	1999
Penmaen Burrows	41	SS5388		1992
Nicholaston & Oxwich Burrows	41	SS5087	196 (1966)	1986
Horton Dunes	41	SS4685		1981
Llangennith & Broughton Burrows	41	SS4192	21 (1964)	1981
Whiteford Burrows	**41**	**SS4394**	**137 (2005)**	**2015**
Pembrey Burrows	**44**	**SS4298**	**9 (1987)**	**2015**
Laugharne & Pendine Burrows	44	SN2807	87 (1964)	1990
Tenby Burrows	45	SS19		1829
Stackpole Warren	45	SR9995		2000
Brownslade & Linney Burrows	45	SR8898	341 (2000)	2013
Broomhill Burrows	45	SM8800		1997

Whiteford Burrows: strandlines form important habitats for invertebrates

beetle has been seen at only five sites over the last 15 years – Brownslade & Linney Burrows, Merthyr Mawr Warren, Pembrey Burrows, Stackpole Warren and Whiteford Burrows. Recently, strong populations have been confined to Frainslake Sands on Brownslade Burrows and to Whiteford Burrows (Table 2). Worryingly, adults were only found at Pembrey Burrows (a singleton) and Whiteford Burrows (15) in 2015.

Whilst regular monitoring by Ministry of Defence staff and others at Frainslake Sands indicates that adult numbers can fluctuate markedly from one year to the next (Table 2), the lack of any sightings at its most important UK locality since 2013 and the lack of a high count since 2005 is worrying.

Table 2. Peak annual counts of adult Strandline Beetle at the two key Welsh dune systems. Counts at Frainslake Sands are undertaken systematically by the MoD whilst those at Whiteford Burrows refer to *ad hoc* records.

Year	Frainslake Sands	Whiteford Burrows
1997	314	-
1998	156	-
1999	198	27
2000	341	34
2001	26	123
2002	45	43
2003	21	30
2004	202	53
2005	270	137
2006	30	-
2007	17	16
2008	1	6
2009	5	1
2010	6	-
2011	2	2
2012	11	5
2013	3	2
2014	0	-
2015	0	15

Causes of decline – can anything be done?

Beach-cleaning operations are implicated in the loss of the population at Berrow Dunes and there is some anecdotal evidence of impacts at Welsh localities. To counter this, volunteer beach cleaners on National Nature Reserves such as Merthyr Mawr Warren and Whiteford Burrows are asked to leave natural debris such as driftwood in situ. The removal or burning of driftwood for beach barbeques could also be a threat. However, none of these explains the lack of recent records from Frainslake Sands where strandlines are left mostly intact.

Recent losses may be a consequence of severe winter storms which remove over-wintering sites within the frontal dunes. Gibbs[7] suggested that the loss of pioneer dunes to a steeper dune frontage at Frainslake Sands had reduced the availability of suitable habitat, with most of the few beetles seen in 2007 being confined to areas of the strandline backed by low frontal dunes. Perhaps it is not surprising that adults have not been found at Frainslake following the loss of 3-5m of the frontal dunes during the 2013-14 storms, particularly when this occurred at a population low point. On Pembrey Burrows, frontal dunes retreated by more than 20m

Strandline (beachcomber) beetle *Eurynebria complanata*

in places, leaving high, steep dune faces[9]. If these prove to be an obstacle to accessing overwintering sites, the beetle may be currently restricted to strandlines backed by low frontal dunes at the eastern and western ends of the system.

If winter storms are a major factor in population losses, there may be little we can do to prevent the extinction of the Strandline Beetle. We should at least ensure that a plentiful supply of driftwood, seaweed and other natural flotsam remains on the strandlines at recently occupied sites. Regular searches and counts of adult numbers need to be continued to keep a check on the status of this interesting but vulnerable beetle.

Acknowledgements

Thanks to MoD staff, and particularly Lynne Houlston, for undertaking counts at Frainslake Sands and providing data; to NRW colleagues and others for providing their records; and to David Painter for images of the beetle and its habitat.

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Y chwilen draeth

Chwilen y llawr yw'r *Eurynebria complanata* a gysylltir yn bennaf ag ymylon traethau tywod lle ceir twyni arfordirol. Mae'r chwilod llawn dwf yn greaduriaid nosol, ac yn bwydo'n bennaf ar chwain y traeth ac yn cysgodi mewn malurion yn ystod y dydd. Cawsant eu cofnodi mewn 14 safle yng Nghymru, ond dim ond mewn 5 safle yn ystod y 15 mlynedd diwethaf. Yn 2015 cofnodwyd chwilod llawn dwf mewn 2 safle yn unig. Efallai mai gwaith clirio traethau sy'n rhannol gyfrifol am hyn, gan ei fod yn cael gwared â chynefin hanfodol, ac efallai bod stormydd geirwon wedi dinistrio safleoedd gaeafu ymysg y blaendwyni.

Andrew Shaw

Earthstar fungus *Geastrum britannicum*: coming soon to a churchyard near you

Geastrum britannicum at St. Teilio's Church, Llandeilo Graban, Radnorshire

Species of fungus previously unknown in the UK are found on an annual basis but it's not every day that a species new to science is found, especially one that is both eye-catching and apparently widespread. ***ANDREW SHAW*** *charts the progress of this new earthstar.*

Last year an intriguing-looking earthstar *Geastrum* was described new to science by a Spanish-led team of researchers who were investigating the worldwide *Geastrum* genus. The team named the new species *Geastrum britannicum* in recognition of the fact that this fascinating species has yet to be recorded outside Britain. Mycologists at the Royal Botanic Gardens, Kew, had been aware of this new species since 2013 when a puzzling-looking earthstar was collected by Jo Weightman from a churchyard at Cusop in Herefordshire. A search of the Kew Fungarium (which holds over 1.25 million specimens of dried fungi from around the world) revealed seven additional collections from five other sites. No specimens from overseas collections could be found at Kew and there is no evidence to suggest that it occurs elsewhere in Europe[1, 2, 3]. Prior to Jo Weightman's find, the earliest collection at Kew is from Breamore, Hampshire, and was made by Marion Nesbitt as recently as 1994. Kew had even lined up a name for the new species but was pipped at the post of describing it new to science by the Spanish researchers. The paper describing the new species[4] is based on DNA analysis of three specimens that had been assigned to the four-rayed earthstar *G. quadrifidum* on

loan from the Kew Fungarium. The holotype specimen of the new species was originally collected from under a pine tree in Cockley Cley, Norfolk, by Jonathan Revett in 2000.

To date there are 18 confirmed sites for the new species, and it appears to be spreading rapidly[1]. So far it has been confirmed from: Breconshire (Llandefaelog Fach and Llansantffraed), East Norfolk (Surlingham), Herefordshire (Ashperton, Cusop and Yarpole), Monmouthshire (Abergavenny), North Somerset (Ashton Court), Shropshire (Ashford Carbonell), South Hampshire (Breamore), Surrey (Esher), and West Norfolk (Cockley Cley and Rushford). In Radnorshire I and a small troop of 'earthstar hunters' have undertaken targeted searches of potential sites and have discovered the new species at Clyro, Glasbury, Llanddewi Fach, Llandeilo Graban and Nantmel.

Andrew Shaw

Dry specimen of Geastrum britannicum showing some key features.
Dark brown conical peristome with halo (A). Whitish-pruinose spore-sac (B). 5-7 rays attached to mycelial cup (C).

Lifecycle

The earthstars are amongst our most extraordinary looking species of fungus. The immature onion-shaped fruit body develops at, or just below, the surface of the ground. On maturity the exoperidium (outer layer) splits, usually into five to seven rays, to reveal a puffball-like spore-sac (peridium). The spore-sac has an ostiole, a small opening near the apex through which the spores are released when the soft leathery spore-sac is hit by drops of rain water. In a number of species (including *G. britannicum*) the rays arch backwards so as to elevate the fruit body off the ground and raise the spore-sac for optimal spore dispersal. This extraordinary cantilevering spore dispersal mechanism is considered by some mycologists to be amongst the most advanced evolutionary adaptation in all the fungi. Including the newly described species, there are currently 17 species of earthstar recorded from Great Britain and Ireland, many of which are rare. Approximately 120 species are known worldwide.

Andrew Shaw

Earthstar habitat at St. Teilio's Church, Llandeilo Graban, Radnorshire

The newly described species is one of three so-called fornicate species of earthstar that occur in Great Britain and Ireland. These earthstars have a cup-like basal membrane (mycelial cup) to which the rays of the expanded fruit body are attached at their tips. In all other British earthstars this basal tissue does not separate, so that the ray tips are unattached and usually rest on the ground. All three fornicate species are fibrous and dry out when growing in

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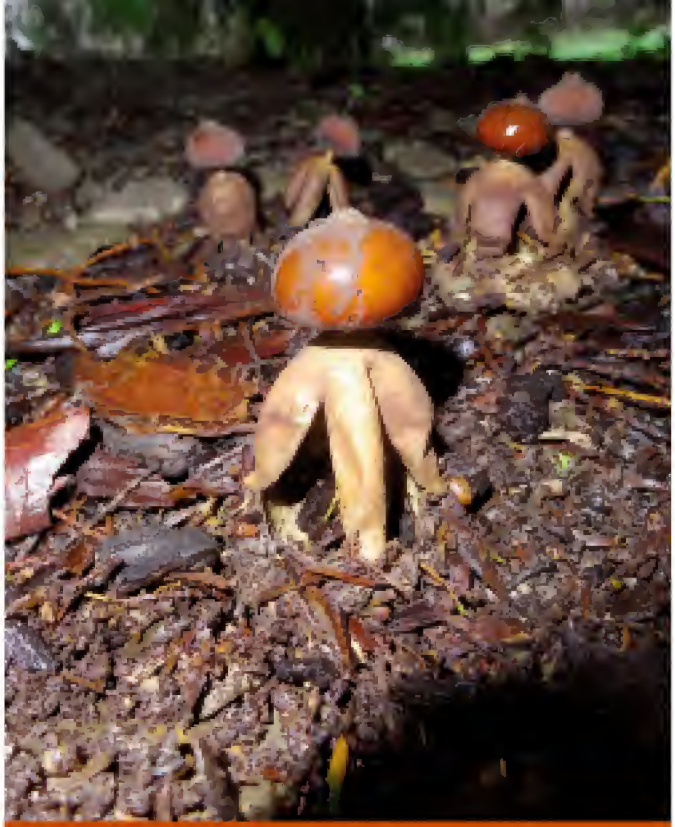

A troop of *Geastrum fornicatum* underneath an ancient Yew tree at St. Michael's Church, Discoed, Radnorshire

sheltered locations, and as a result old fruiting bodies can often be found well outside the usual autumn fruiting time. In favourable conditions some old fruiting bodies may even survive a number of years, often becoming detached from the ground, resulting in windblown specimens being found some distance from their original location.

G. britannicum is usually around 3-4 cm in height and up to 5 cm across when expanded. It has been confused with the two other British fornicate species; arched earthstar *G. fornicatum* and four-rayed earthstar *G. quadrifidum*, both of which are scarce but widespread and often grow in similar habitats.

The most conspicuous features of *G. britannicum* are the 5-7 rays, a whitish-pruinose spore-sac (best seen in dried specimens), and a strongly delimited, dark brown, conical peristome which has a distinct halo around the base. The halo is not obviously raised in fresh specimens (but becomes raised in mature dry specimens).

G. fornicatum is usually much larger (up to 8 cm high), has four (occasionally five) rays, a grey-buff spore sac, and lacks a halo around the base of the peristome.

G. quadrifidum differs in the shape and colour of the spore-sac which is usually somewhat oval, taller than broad, and greyish, usually lacking an obvious pruina in older specimens. It also differs in having only four (rarely five) rays, and a well-delimited but whitish peristome with a slightly raised halo in fresh (and dry) specimens.

To date 13 of the 18 confirmed sites for *G. britannicum* are churchyards where the earthstar grows under old yew trees. Occasionally *G. fornicatum* and *G. quadrifidum* may be found in the same churchyard, but usually under a separate yew tree. Like many other species of earthstar, *G. britannicum* appears to require dry conditions; such conditions are found under the overhanging branches of old yew trees where the ground is generally bare but may also support ivy and scattered annual weeds. At St. Michael's Church in Clyro, Radnorshire, it grows on a shallow layer of fallen yew tree needles that have collected over the concrete tomb of William & Sarah Williams. At St. David's Church, Llanddewi Fach, also in Radnorshire, it grows on shallow soil and yew tree needles that have collected over a collapsed drystone wall. Such areas are free draining and are likely to be subject to desiccation in the summer months. However, any direct relationship with yew trees is ruled out by the fact that five of the recorded English sites are away from yews, three by roadsides (one near pine, one near oak and the other with no trees noted) and the other two recorded as 'inside ancient oak trunk' and amongst 'wood debris' in a mixed woodland[1].

Where had *G. britannicum* been hiding prior to 1994? It seems unlikely that this very distinctive and conspicuous species is a historically overlooked native species. It is most likely a recent coloniser, but whether this is a result of natural dispersal or

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Recently emerged Four-rayed earthstar *Gaestrum quadrifidum* showing typical spore-sac shape and whitish peristome

accidental introduction is, along with its place of origin, a mystery. The most obvious threat to *G. britannicum* and other churchyard earthstars is the direct loss of bare ground under yew trees. Most churchyards have piles of grass cuttings, old grave stones, and other waste material dumped under a conveniently located yew. This habit of dumping material under old yews will almost certainly have resulted in the loss of some earthstar populations and perhaps other rare organisms that are associated with this very specialised, albeit very localised habitat.

There will undoubtedly be many new sites where *G. britannicum* awaits discovery and considerably more suitable sites that await colonisation. Other new sites are likely to come to light where *G. britannicum* has previously been misidentified. For example, the excellent photograph labelled as *G. fornicatum* in the Brecon Beacons New Naturalist (No. 126. 2014) is in fact *G. britannicum* (taken before *G britannicum* had been described). It will be fascinating to plot the continued spread of this exciting new addition to the British fungal list.

Andrew Shaw *is Director of Ecology Services, an ecological consultancy specialising in protected species and habitat assessment. He saw his first (and at the time unnamed)* G. britannicum *in a Breconshire churchyard in 2013. www.eco-serv.com; andrewgshaw@hotmail.com*

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Ffwng Seren y Ddaear *Geastrum britannicum*

Yn 2015 canfuwyd rhywogaeth cwbl newydd o ffwng a chwbl ddieithir y tu allan i Brydain, a chafodd ei henwi yn *Geastrum Britannicum*. Sêr y ddaear yw'r enw ar ffyngau rhyfeddol hyn. Mae ganddynt gorff crwn chwyddedig sy'n ymrannu'n bump neu saith pelydryn pan fyddant yn cyrraedd llawn dwf. Yn y *G. britannicum*, fel gyda sêr y ddaear eraill, mae'r pelydrau yn pontio'n ôl i godi'r sach sborau oddi ar y ddaear. Cadarnhawyd bod y mwyafrif wedi eu canfod o dan hen goed yw mewn mynwentydd, ar ddaear sych lle ceir nodwyddau yw ac ychydig o blanhigion. Hyd yma, cadarnhawyd fod y ffwng i'w gael mewn wyth safle yng nghanolbarth a de Cymru.

All photos: P. Day

Trelogan - a small Welsh village with a worldwide reputation

University of Liverpool research plot looking south westwards

Trelogan is a small village in north Flintshire with a long history of metal mining. ***PAUL DAY*** *and* ***PHIL PUTWAIN*** *explain how its mining legacy produced both interesting plants and an open-air laboratory which have provided one of the finest demonstrations of evolution in action.*

Research carried out on the un-reclaimed mine wastes at Trelogan from the 1960s to the present time has gained worldwide recognition for demonstrating the evolutionary significance of metal tolerance in plants. Metal tolerance is the ability of some plants to grow in soils that are rich in heavy metals (lead and zinc in this case) at levels that would kill plants originating from normal soils. The special characteristics of the Trelogan mine wastes have made an important contribution to humanity's ideas about the process of evolution and helped to shape the development of general evolutionary theories.

The research was undertaken by scientists principally from the University College of North Wales (UCNW, now Bangor University) and, subsequently, the University of Liverpool. This was led by Professor Anthony (Tony) Bradshaw (1926-2008) who arranged a lease at Trelogan to create the 0.5 ha fenced research site, which still exists. The story of this research and the nature conservation significance of Trelogan has not been told before and it is hoped that this publication

will lead to wider recognition and secure the future of this historic site.

Mining history

Trelogan, close to the villages of Trelawynd and Dyserth, was one of the principle lead mining areas in north-east Wales. It was one of many mines working the north-eastern edge of the Carboniferous Limestone belt, with its rich veins of lead, zinc and silver, which lie east of the Vale of Clwyd and the Clwydian Hills AONB, and which stretch from Prestatyn's Talargoch Mines in the north to the Bala Fault and Minera Mines in the south[1].

The first mentions of mines at Trelogan date from the late 17th century, and work finally ended in 1911 with the closure of the Hannah Shaft/Lower Trelogan Mine[2]. Before the mid-19th century the focus of activity was close to the current village of Trelogan but later mining occurred further away to the north-east and the Lower Trelogan mine.

The Lower Trelogan mine was reclaimed in the late 1990s by the local authority, and other areas of mine tailings have been subject to *ad hoc* reclamation by over-tipping with soils over a number of years. However, there are still significant areas remaining which provide evidence of the area's former mining activities.

The discovery of metal-tolerant plants

In 1952 Tony Bradshaw first reported the existence of a population of common bent *Agrostis capillaris*, tolerant of lead and zinc, growing on a disused lead mine at Goginan near Aberystwyth[3]. Thirteen years later at UCNW, research on plant populations collected at Trelogan demonstrated that several grass species – common bent, creeping bent *A. stolonifera*, sheep's fescue *Festuca ovina*, red fescue *F. rubra* and sweet vernal grass *Anthoxanthum odoratum* plus a hybrid bent *A. capillaris* x *A.stolonifera (A. x murbeckii)* – had evolved high tolerance to zinc and lead[4]. In contrast, the same species populations collected from adjacent pastures exhibited negligible tolerance to the metals.

Generally, tolerance was specific to a particular metal and there was also a strong correlation between the

Typical Calaminarian Grassland community with spring sandwort, mountain pansy and sheep's sorrel with abundant lower plants

degree of metal tolerance in grasses growing on zinc and lead mines and the concentration of these metals in the mine spoil. At Trelogan the total concentration of zinc in spoil varied from 31,000-80,000 mg/kg of dry spoil and from 3,600-20,500 mg/kg for lead, compared to 100-220 mg/kg for zinc and 25-50 mg/kg for lead in normal soils.

The evolution of metal tolerance

The evolution of metal tolerance at Trelogan was also of particular interest because, in contrast to conventional wisdom at that time, it had been very rapid. The waste tips were of fairly recent origin, approximately 60-300 years old, although mining for lead and silver was active at nearby Halkyn Mountain in Roman times and possibly earlier. Thus previously evolved metallophyte (metal-tolerant) plants may have arrived at Trelogan with miners or equipment transferred from Halkyn or elsewhere.

Professor Bradshaw and his co-workers concluded that the ability to survive on severely metal-contaminated soils was clearly a genetically determined character. The movement of genetic material (gene flow) between the mine and pasture populations at Trelogan is through the movement of pollen, mainly by the wind. This brings pollen from non-metallophyte plants to metallophyte plants on the mine waste, thus increasing the likelihood of these plants producing metallophyte seed. In spite of this, it was first demonstrated by one of the authors (PP) that there was a very rapid change in the metal tolerance of sweet vernal grass across the north-west

boundary between mine spoil and the adjacent pasture, over a distance of approximately eight metres[5].

At that time the prevailing scientific view was that gene flow in plant populations (especially wind-pollinated ones) was so strong that it was impossible for evolutionary differentiation to appear on a small scale. The research at Trelogan, and other mine sites in Wales, clearly demonstrated that geographic isolation was not necessary for distinct populations to evolve. Professor Bradshaw and Janis Antonovics proposed that mine and pasture populations would develop mechanisms to reduce the harmful effects of gene flow. As predicted, earlier flowering was revealed in mine populations of sweet vernal grass. The self-fertility of mine populations also was shown to be greater than that in pasture populations. Antonovics showed that the flowering time differences had persisted for over 40 years at Trelogan[6].

Metal-tolerant plants do not spread far into adjacent pastures. Zinc-tolerant plants grew satisfactorily on uncontaminated soils but, when in competition with non-tolerant plants, their growth was substantially suppressed. There was strong selection pressure against the tolerant type, which die out in adjacent pastures. This explained the rapid transition from completely metal-tolerant populations on the mine to completely non-tolerant populations in the adjacent pasture[7]. Given the wealth of evidence, there is no doubt that the discovery of the speed and local scale of evolution in grass populations remains one of the finest demonstrations of evolution in action, showing the ability of natural selection to bring about rapid evolutionary changes.

Other experiments showed that the ability of plants to colonise metal-contaminated sites was not just conferred by genetic tolerance to metals but was also the result of tolerance to acute deficiencies of major plant nutrients such as phosphorus and nitrogen, tolerance of extremes of soil pH, and tolerance of drought, which typically occur on the mine spoils. Tolerant plants of sweet vernal grass and common bent were generally shorter and more prostrate than corresponding pasture plants and had a smaller number of flowering tillers. Thus the evolution of tolerance to metals, although predominant, was just one element in a complex interaction of selection pressures imposed by the harsh mine environment.

Application of science: the establishment of vegetation on toxic wastes

The toxic spoils left behind by mining operations can be a source of pollution through dust-blow and surface erosion by rainfall. These spoils are often restored by covering them with inert material,

University of Liverpool research plot looking northeastwards.

Leadwort or spring sandwort, *Minuartia verna*

but an alternative approach, pioneered by Tony Bradshaw and his co-workers at Liverpool University, was to sow metal-tolerant seed of grasses such as red fescue or common bent that had been selected and bulked up from mine populations. A large-scale trial of red fescue was undertaken at Lower Trelogan mine and proved successful in maintaining good vegetation cover for seven years after sowing.

Seed from the most tolerant red fescue was developed as the commercial cultivar 'Merlin' by the National Seed Development Organisation. Many people in Japan, Australia and North America are familiar with the names 'Merlin' and 'Trelogan'. These countries have extensive areas of mined land contaminated with heavy metal wastes and 'Merlin' has been used for zinc-contaminated mine restoration throughout the world.

Trelogan as a SSSI

Professor Bradshaw promoted the notification of Trelogan as a Site of Special Scientific Interest (SSSI) in the late 1970s/early 1980s and subsequently in the 1990s. He considered that the term SSSI should encompass man-made sites of scientific importance as well as semi-natural sites with particular ecological interest. To justify the selection he provided evidence that more scientific papers have been written on Trelogan than any other comparable area of land in Britain. He also showed that it was the best site of its type in demonstrating a species-rich metal-tolerant flora with a sharp delineation to normal pasture. Additionally, he was concerned about the rapid loss of such sites to reclamation and the possibility that the University of Liverpool lease would expire.

In 1980 the Nature Conservancy Council (NCC), which at that time had no specific guidelines for selecting SSSIs on man-made habitats such as heavy metal waste, decided to present Trelogan as a test case for notification on the grounds of "rare pedological (soil science) interest supporting interesting plant ecotypes". The proposed SSSI simply encompassed the fenced University of Liverpool experimental plot but, following consultation and considerable deliberation, NCC decided not to notify the site.

From the 1990s Trelogan's heavy metal substrates and their metal-tolerant vegetation became recognised for their ecological and nature conservation importance. They are an example of Calaminarian Grassland, which is listed in Annex 1 of the European Habitats Directive. This grassland is a locally widespread but uncommon habitat found mainly in the north and west of Britain including the Pennines, Cumbria, Wales and Scotland.

The Countryside Council for Wales (CCW) then reviewed the suite of heavy metal mine sites in Wales. They found that the north-east Wales ore-field supported calcareous swards with abundant spring sandwort *Minuartia verna* comprising stands of National Vegetation Classification OV37, *Festuca ovina-Minuartia verna* community[8]. Halkyn Mountain supports the largest extent of metallophyte vegetation in Wales, albeit spread across a large

Colourful Calaminarian Grassland with spring sandwort and mountain pansy

area of mainly common land, and was selected as a Special Area of Conservation (SAC).

In order to represent the range of variation within the Calaminarian Grassland in the Clywd Area of Search (AoS)[9] for SSSIs, CCW recommended the notification of two further sites, one of which was Trelogan[10]. Trelogan supports the second largest example of Calaminarian Grassland in the AoS and supports certain metallophyte species not found elsewhere including mountain pansy, *Viola lutea*.

Trelogan was notified as a SSSI on 7 August 2012, some 30 years after Tony Bradshaw originally promoted it. It is now called Glaswelltiroedd Trelogan/Trelogan Grasslands SSSI. It is considerably larger than the original Trelogan research site as it includes all remaining areas of Calaminarian Grassland in the vicinity[11].

The Trelogan Calaminarian Grasslands

Calaminarian Grassland is spread throughout the SSSI with the largest areas within the University of Liverpool fenced compound and its immediate environs and to the west of White Horse Farm. It is characteristically open in character with a mixture of short-growing metallophyte vascular plants, bryophytes and lichens. There is frequent spring sandwort and locally abundant mountain pansy. Spring sandwort was well known to miners as indicative of heavy metal soils and which they called leadwort. Other characteristic species include common sorrel *Rumex acetosa*, ribwort plantain *Plantago lanceolata* and mouse-ear chickweed *Cerastium fontanum*. Thyme *Thymus praecox* and kidney vetch *Anthyllis vulneraria* occur more sparingly. More closed swards are grasses dominated by sheep's fescue, sweet vernal grass and common bent.

There is also a prominent component of lichens and mosses, including metallophyte species such as *Bryum pallescens*, *Weissia controversa var. densifolia* and *Brachythecium velutinum*.

Future management of Calaminarian Grassland at Trelogan

This rare grassland occurs on the edges of the village and is vulnerable to various pressures, including vehicle activity and recreation. Fly-tipping, particularly of garden wastes, has spread a variety of non-native species in the area. Much of this land is registered as common with open public access. There are, however, no rights of common registered and therefore no active land management occurs, including any grazing by farm livestock. This might over time lead to successional change including scrub encroachment, particularly of common gorse *Ulex europaeus*, so active management will be required to maintain the special quality of these grasslands.

The main threat to this habitat has historically been land reclamation/restoration and the reworking of the mine spoil heaps. The area used by the University of Liverpool for research has also diminished over time but they continue to conserve their research site through a leasing agreement with the landowners.

As metal mining no longer occurs there is no new mine waste habitat being created, and there may be potential to expand this habitat at Trelogan. This could be through topsoil removal where this has been used to bury heavy metal wastes or where the existing vegetation, such as areas with prominent common sorrel, suggests residual metal toxicity.

Conclusion

Through the work of Professor Bradshaw and his research workers, the mine wastes at Trelogan have made a major contribution to human understanding

Mountain pansy, *Viola lutea*-only the yellower flowered form present

of evolution in plant populations. The discovery of the speed and local scale of evolution in grass populations remains one of the finest demonstrations of evolution in action. The results of this pioneering research have led to the development of scientific methods for the restoration of degraded land, techniques that are now used across the world.

Trelogan has a truly worldwide reputation and, through this article and its protection as a SSSI for its rare flora, it is hoped that this small site will be more widely recognised and valued, and long-term management put into place to ensure its future survival.

***Paul Day** worked in nature conservation in north-east Wales for over 30 years and retired in 2014 from Natural Resources Wales. As a former Liverpool University postgraduate he was pleased to assist in delivering Tony Bradshaw's wishes to achieve the designation of Trelogan as a SSSI. **Dr Phil Putwain** was a senior lecturer at the University of Liverpool who worked closely with Tony Bradshaw and his students. Phil is currently an Honorary Research Fellow in the School of Environmental Sciences at the University and also runs an environmental consultancy company specialising in ecological restoration.*

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Planhigion sy'n gallu goddef metelau

Mae gwaith ymchwil ar wastraff cloddfeydd na chafodd ei adfer yn Nhrelogan wedi cael cydnabyddiaeth ryngwladol am ddangos y gall esblygiad ddigwydd yn gyflym ac ar raddfa fechan. Yma, mae rhai planhigion wedi esblygu'n gyflym i allu goddef halogiad gan fetelau trwm mewn priddoedd a fyddai'n lladd planhigion eraill. Maent yn arddangos priodweddau mor wahanol fel na allant gystadlu â phlanhigion anoddefgar ar bridd normal ychydig fetrau i ffwrdd. Mae pridd gwenwynig yn aml wedi ei orchuddio â deunyddiau anadweithiol i rwystro llygredd, ond efallai y byddai hau hadau planhigion sy'n gallu goddef metelau yn well ateb.

All photos: Jeremy Moore

A photographer's journey – from landscapes to birds in their habitat

Arctic Tern *Sterna paradisaea* Môrwennol y Gogledd

The advent of digital cameras changed the world for bird photographers. ***JEREMY MOORE*** *has progressed from taking images of landscapes to photographing birds in their landscape. He describes this journey culminating in his new Bird/Land exhibition, in which letterbox-shaped photographs are displayed as a triptych.*

Leaving university in 1975 with a degree in psychology I knew what I didn't want to do next – anything to do with psychology! But during that time my real concerns had emerged and I began to learn as much as I could about wildlife and conservation. My interests in photography were growing in parallel, and a move to rural Wales in 1977 was helpful in both aspects of my development. For a number of years I worked for the RSPB and other organisations doing bird protection and survey work. I saw some fabulous wildlife during that time but serious photography was not really an option. Protection and conservation always came first. If I carried a camera at all it was likely to be used to photograph the landscapes I was passing through, not the wildlife I was recording. This pattern continued for many years, even after I left the world of professional conservation – I watched wildlife and photographed landscapes.

A first venture into professional photography came during the late 1980s with the publication of my first batch of Wild Wales / Cymru Cyllt scenic postcards. This proved reasonably successful and after a few

years it became a way of earning a modest living. The split between what I watched and what I photographed became further entrenched. I produced a series of books with several authors for Gomer Press, including, in 2003, *Heart of the Country* which included a selection of the late William Condry's Guardian Country Diaries. But after 20 years or so I became somewhat disillusioned with landscape photography and felt that I needed a new challenge. Why not combine my interests and begin photographing what concerned me the most? So I gingerly purchased my first long lens. I wouldn't say it was a revelation but it certainly gave my photography a new lease of life.

Some pictures and the story behind them

Arctic Tern: Perhaps typical of the bird photography genre these days is this image of the Arctic tern holding a sand-eel for its mate. The bird is visually extracted from its surroundings and any background blurred out as far as possible. The photograph was taken on The Skerries, off the north coast of Anglesey, at one of the largest Arctic tern colonies in Britain. Those lucky enough to visit the island have just an hour to enjoy the spectacle that thousands of terns present, while supplies for the RSPB wardens are unloaded. On this occasion it was still early in the breeding season and the birds were not yet defending eggs or young. Every so often the whole colony would rise up and sweep away before quickly returning. So it proved to be a slightly frustrating visit for me and I had put my equipment away ready for the return journey when this perfectly-lit little creature landed nearby. I prayed that it would stay long enough for me to unpack my gear, and to my delight it did.

Starling roost: Living near Aberystwyth, I'm always in search of the perfect image of starling flocks in flight. Many thousands of these birds roost under Aberystwyth pier from autumn until early spring, and on a bright winter's evening a small gaggle of photographers can usually be found there. If only the starlings were as predictable! One is spoilt by seeing stunning still images and videos of the birds swirling around in amoeba-like displays, but in fact they seem to perform them quite rarely. All too often the first small flock quickly flies in under the pier and starts chattering. Upon hearing this sound every subsequent arrival of birds will quickly follow in. Just occasionally large flocks will swarm over the pier and the town, particularly in March, and if a peregrine is in attendance the full display may be seen. It may be avoidance behaviour designed to outwit and confuse the predator. Just once in a while the photographer can be in the right place at the right time.

Starlings *Sturnus vulgaris* Drudwennod

Bittern *Botaurus stellaris* Aderyn y bwn

Bittern: One species on most bird photographers' 'to die for' list must be the bittern. They are known to winter in the Teifi Marshes, near Cardigan, but are seen only a handful of times every year. Early one winter's morning I drove down to the site, which is a reserve of the South and West Wales Wildlife Trust. I left my van and headed for the Creek hide. I jokingly told another photographer before hurrying off that I was expecting to see a bittern at the Kingfisher hide. When I arrived I was gobsmacked to find that there actually was one right out in the open! I clumsily and noisily unpacked my gear and managed a few images before it disappeared into the reeds. It was around all day and I was able to show it to many other visitors

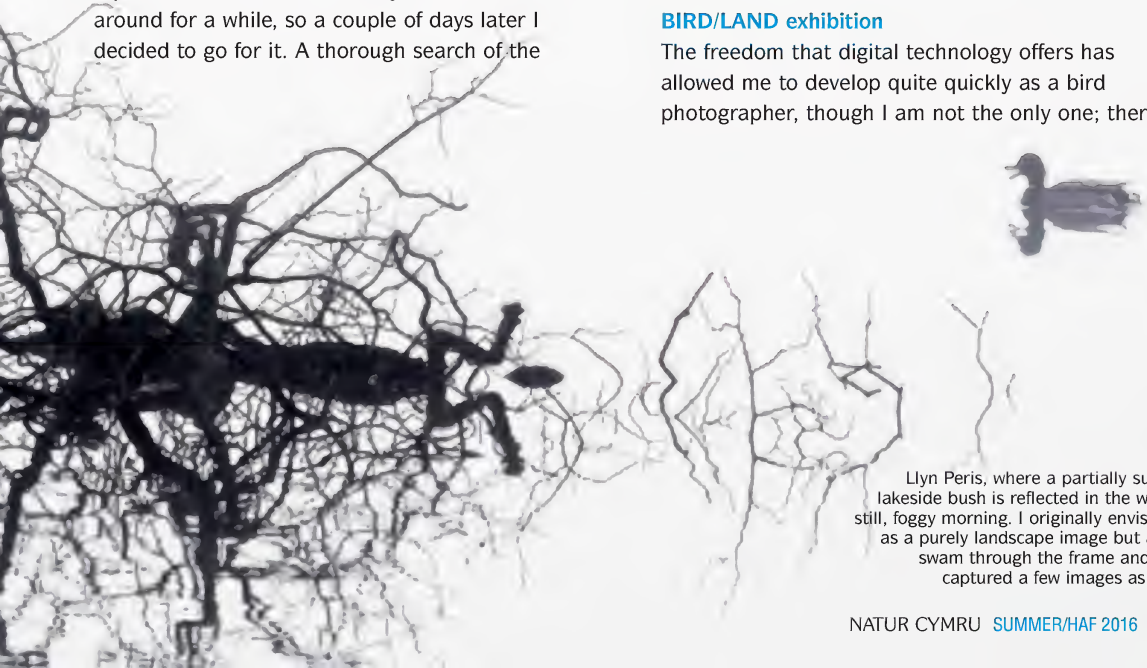
Dotterel *Eudromias morinellus* Hutan y mynydd

during that time. The best image of all was taken through the hedge from the cycle track later in the afternoon.

Dotterel: These lovely birds are known for 'mountain-top-hopping' while migrating from the Atlas mountains to breeding grounds in Scotland or Scandinavia. Pumlumon is a known stopping-off point and in April 2015 a single female was reported from its summit. They are known to stick around for a while, so a couple of days later I decided to go for it. A thorough search of the summit plateau yielded nothing. Then there was a movement on the ground a couple of yards in front of me. There she was! The females are more colourful than the males and largely take the male role in the relationship. After laying a clutch of eggs, she leaves the male to incubate them and may head northwards again to find another mate. Dotterel are such approachable birds and I spent a very happy hour photographing her.

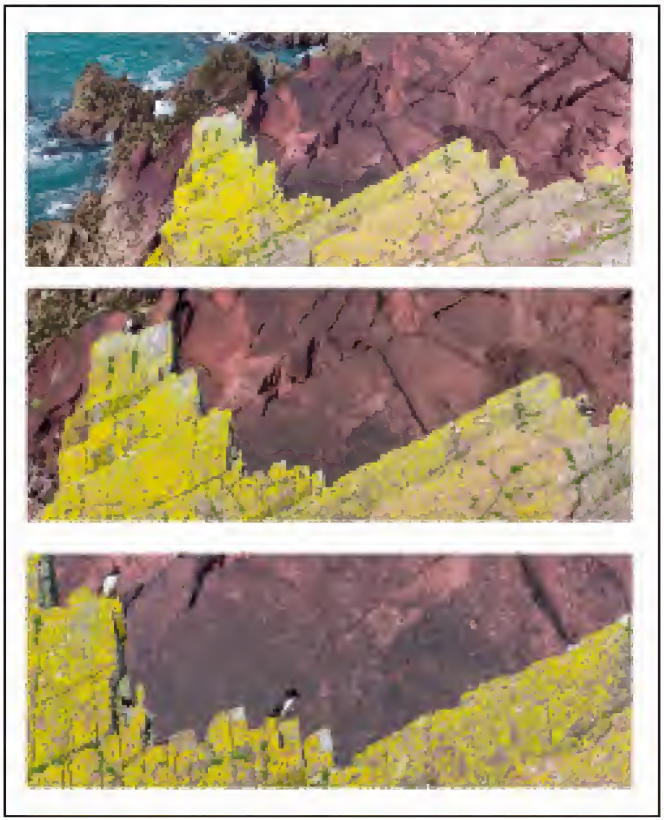
BIRD/LAND exhibition

The freedom that digital technology offers has allowed me to develop quite quickly as a bird photographer, though I am not the only one; there



Llyn Peris, where a partially submerged lakeside bush is reflected in the water on a still, foggy morning. I originally envisaged this as a purely landscape image but a mallard swam through the frame and I quickly captured a few images as it did so.

The triptych format



are now many exceptional bird photographers around. What I did have after many years of photographing the landscape was a visual awareness of the birds' environment and it became my intention to show birds within their surroundings. Each would have equal billing, if you like. I found the work of artists in other media particularly inspiring in this respect. I admired the Rakusan Kachou Gafu – bird and flower wood block prints by the Japanese artist Rakusan Tsuchiya. In these the bird may be partly obscured by its surroundings, or perched near the edge of the frame, looking outwards. Anathema to the bird photographer!

I also particularly enjoyed the work of the painter Michael Warren, whose accurately depicted bird subjects are set within stylised and often surreal surroundings. His paintings are 'in focus' from the closest foreground detail to the furthest horizon, something the photographer will never be able to achieve. The limitations of optical equipment are just too great.

With a view to obtaining Arts Council of Wales support for an exhibition, I wondered what I could do to distinguish my work from that of other bird photographers. While processing my images I had discovered that cropping them to a letter-box shape gave a very attractive result. This is a commonly-used format in landscape photography but, by retaining a good sense of the subject's surroundings, it also seems to work well with wildlife. Just to make it particularly difficult for myself – but in the end more satisfying – I decided to combine three or more panoramic format images within each frame. The images would be linked by species, location, or aesthetic considerations, and sometimes all three. So that became my intention, and my grant application was successful.

The resulting exhibition, BIRD/LAND was first displayed in Machynlleth from June until September 2015. Though there are a few single images, most of the works in the exhibition are in the triptych format. A revised and enlarged version of the exhibition will be shown at Aberystwyth Arts Centre from June 25th to August 29th 2016.

__Jeremy Moore__'s most recent book was Wales at Waters Edge, with the author Jon Gower. They are currently working on a new book about Wales's wild places.

Taith ffotograffydd

Rai blynyddoedd yn ôl dechreuodd Jeremy Moore ddilyn trywydd arall â'i sgiliau ffotograffiaeth tirluniau gan ymddiddori mewn pwnc newydd, a'r canlyniad oedd arddangosfa *BIRD/LAND* sy'n canolbwyntio ar bortreadu adar yn eu hamgylchedd. Mae'r fformat triptych yn cysylltu rhywogaeth, lleoliad ac estheteg. Yn aml mae'r ffotograff perffaith yn cael ei dynnu ar ôl oriau o ddisgwyl amyneddgar, ond ar adegau eraill mae popeth yn digwydd ar hap a damwain a bydd y lens yn y lle cywir ar yr adeg gywir.

Lluniau - Gethin Davies/ACPE

Eryri – mwy na mynyddoedd

Ffair Bioamrywiaeth Eryri

Mae ***GETHIN DAVIES*** *yn gwybod cystal â neb sut y mae profiad cynnar o fod allan yn yr awyr agored, a threulio amser ar draethau Cymru, yn gallu dylanwadu ar ddiddordebau a hyd yn oed ar drywydd gyrfa. Felly mae Taith Bioamrywiaeth flynyddol Awdurdod Parc Cenedlaethol Eryri, sy'n bwriadu canolbwyntio eleni ar gynefinoedd morol y Parc, yn agos at ei galon. Yn yr erthygl hon mae'n egluro mwy am gefndir y Daith Bioamrywiaeth flynyddol, ac yn rhoi blas o'r gweithgareddau y bydd plant o dair ysgol gynradd arfordirol yn eu mwynhau yn ystod mis Mehefin 2016.*

Mewn oes sydd wedi ei rheoli gan gonsolau gemau, ffonau clyfar a thabledi cyfrifiadurol, mae cryn sôn am y diffyg cysylltiad bellach rhwng pobl ifanc a byd natur. 'Does ond rhaid i chi ddarllen cyhoeddiadau fel Natural Childhood Yr Ymddiriedolaeth Genedlaethol i gael eich argyhoeddi bod elfen o wirionedd yn y ffenomenon a ddisgrifir fel 'Anhwylder Diffyg Natur', neu 'Nature Deficit Disorder'[1].

Er mwyn mynd i'r afael â hyn, bu Awdurdod Parc Cenedlaethol Eryri yn cynnal 'Taith Bioamrywiaeth' o amgylch ysgolion Eryri ers pedair blynedd. Y nod yw ceisio addysgu disgyblion am rai o ryfeddodau naturiol y gornel fechan, ond arbennig hon, o Gymru. Cynhelir y daith fel arfer ym mis Mehefin i gyd-fynd ag Wythnos Bioamrywiaeth Cymru, ac mae'r thema yn amrywio o flwyddyn i flwyddyn. Mae cynefinoedd dŵr croyw, coedlannau a phridd wedi cael sylw, ac yn 2015 fe ganolbwyntiwyd ar amgylchedd y nos wrth i ni geisio codi ymwybyddiaeth trigolion y Parc am ymgyrch Awyr Dywyll yr Awdurdod. Yr amgylchedd morol fydd yn cael sylw eleni pan fyddwn yn mynd â disgyblion rhai o ysgolion arfordirol Eryri allan i

ddysgu am eu hamgylchedd morol lleol.

Mae tua 37 milltir o ffin Parc Cenedlaethol Eryri yn arfordir, ac mae'n bwysig iawn o safbwynt cadwraethol. Yn wir, mae holl arfordir y Parc Cenedlaethol wedi ei ddynodi'n Ardal Cadwraeth Arbennig (ACA), ac mae'n ffurfio rhan sylweddol o ACA Pen Llŷn a'r Sarnau. Mae hwn yn ymestyn yn fras o Nefyn i Aberystwyth ac fe gafodd yr ardal ei dynodi oherwydd yr amrywiaeth o gynefinoedd a'r rhywogaethau o bwysigrwydd Ewropeaidd sydd yno. Hon yw un o'r ACAau mwyaf ym Mhrydain!

Mae llawer o ryfeddodau naturiol i'w darganfod ym Mae Ceredigion. Pe baech yn mynd am dro o dan y dŵr ar hyd Pen Llŷn a'r Sarnau fe fyddech, o fewn hanner awr, yn pasio glannau creigiog wedi'u gorchuddio â llygaid meheryn, crancod meudwy a gobïod, cyn nofio dros wely môr tywodlyd sy'n frith o ledod, pysgod bwyell a môr lygod. Gallech sbecian i mewn i'r ogofâu môr tywyll, gyda'u waliau wedi'u gorchuddio ag anemonïau a chwistrellau môr ffa pob. Efallai y caech gip ar lysywen fôr, neu weld morloi llwyd yn diogi!

Gallech fynd drwy'r dyfroedd dwfn agored a dod ar draws heulforgwn deng metr o hyd yn rhidyllu plancton gyda'u cegau anferth, a dolffiniaid a llamidyddion yn llamu uwchben y tonnau. Ac yna gallech gamu allan o'r dŵr ar un o riffiau creigiog y Sarnau neu ymlacio gyda draenogiaid y môr neu hyrddiaid ifanc yng nghilfachau neu gulforoedd yr aberoedd arfordirol. A chofiwch, mae sawl ardal ddynodedig arall ar hyd arfordir Eryri yn ogystal ag ACA Pen Llŷn a'r Sarnau megis ACA Morfa Harlech a Morfa Dyffryn, a phob un â'i chymeriad unigryw ei hun.

Ond eto, mewn gwirionedd, faint ohonom sy'n cysylltu Eryri gyda'r cynefinoedd morol hyn? Dim llawer dybiwn i, gan fod Eryri'n gyfystyr â mynyddoedd i'r mwyafrif o bobl. A dyna pam ei bod hi mor bwysig i ni roi sylw i'r HOLL gynefinoedd arbennig sy'n rhan o Eryri.

Yr ysgolion fydd yn cael ein sylw eleni fydd Ysgolion Tywyn, Ardudwy ac Eifionydd. Mae'r dair ar drothwy arfordir Eryri. Byddwn yn mynd â disgyblion Blwyddyn 7 allan i'w traethau lleol i gymryd rhan mewn amryw o weithgareddau sy'n gysylltiedig â'r amgylchedd morol, fel:

- Casglu ysbwriel morol, a thrafod yr effaith niweidiol mae'n ei gael ar fywyd gwyllt morol, yn ogystal â rhinweddau esthetig a'r diwydiant ymwelwyr yn ein hardaloedd arfordirol.
- Adnabod creaduriaid y draethlin, a dysgu am eu hecoleg a'r nodweddion arbennig sy'n eu galluogi nhw i ffynnu yn y cynefin hynod hwn.
- Gwneud trawstoriad o gynefin twyni tywod, gan ddysgu'r disgyblion sut i adnabod gwahanol blanhigion drwy ddefnyddio allwedd.
- Cyflwyniad gan y bad achub ar bwysigrwydd diogelwch morol.
- Ymweliad gan rai o bysgotwyr Pen Llŷn i siarad am bwysigrwydd economaidd y môr i'r ardal, a pham fod gwarchod cynefinoedd morol a'r poblogaethau pysgod yn bwysig i sectorau megis y diwydiant pysgota yn ardaloedd gwledig Cymru. Os byddwn yn lwcus, efallai cawn gyfle i goginio a blasu peth o ddalfa'r bore hwnnw os bydd y tywydd yn ffafriol!

Yn amlwg, nid yw'r holl weithgareddau hyn yn ymwneud yn uniongyrchol â chadwraeth natur. Ond teimlwn ei bod yn hynod o bwysig i drafod ystod eang o bynciau a materion sy'n gysylltiedig â'r amgylchedd morol yn ystod y daith. Yn y pen draw, maen nhw i gyd yn plethu gyda'i gilydd a hefyd yn ddibynnol ar amgylchedd morol iach.
Wrth gwrs, ni all yr Awdurdod ddarparu'r holl weithgareddau hyn ar ei ben ei hun, felly byddwn yn

cydweithio'n agos gydag amryw o bartneriaid ac arbenigwyr lleol yn ystod y daith. Eleni, gan mai'r amgylchedd morol yw'r thema, byddwn yn dibynnu ar gymorth prosiect ACA Pen Llŷn a'r Sarnau yn ystod y daith. Mae prosiect ACA Pen Llŷn a'r Sarnau yn cynnwys nifer o weithgareddau'n ymwneud â'r amgylchedd morol a phob un yn cynnwys cydweithio rhwng rheolwyr yn y maes, defnyddwyr a thrigolion lleol. Yn eu plith mae:

Prosiect Morwellt Porth Dinllaen: Mae'r prosiect hwn yn edrych ar ddewisiadau gwahanol sydd ar gael i leihau effaith angorfeydd ar y morwellt heb amharu ar y bobl sy'n defnyddio'r ardal. Mae'r prosiect hefyd yn edrych ar sut gall y morwellt gyfrannu at yr economi lleol.
Prosiect Ecosystemau Morol: Prosiect sydd yn cydweithio gyda physgotwyr lleol ar brosiectau morol.
Prosiect Morfa Gwyllt: Mae'r prosiect hwn yn edrych ar y lagŵn (Morfa Gwyllt) wrth ymyl Tywyn yn ne Gwynedd i weld beth ellir ei wneud i wella'r cynefin hwn.
Prosiect Gwylio Dolffiniaid: Lansiwyd cod ymddygiad gwirfoddol yn ddiweddar ar gyfer cychod i geisio sicrhau nad oes unrhyw effaith andwyol ar fywyd gwyllt y môr. Bydd y prosiect hwn yn edrych ar ymddygiad dolffiniaid pan fyddan nhw yng nghyffiniau cychod.

Yn ogystal, bydd prosiect Moroedd Byw Yr Ymddiriedolaeth Natur yn ein helpu, felly rhwng y tri phartner bydd gennym ddigon o arbenigedd i ysbrydoli ac addysgu'r disgyblion am amgylchedd morol gogledd-orllewin Cymru.

Mewn cyfnod o ansicrwydd ariannol, mae gofyn i gyrff cyhoeddus fod yn greadigol iawn gyda'r tipyn arian sydd ganddynt, sy'n rheswm arall pam fod y Daith Bioamrywiaeth yn ddigwyddiad mor llwyddiannus. Ar gyfartaledd, rhyw £600 yw'r gost o'i chynnal bob blwyddyn, ac rydym yn gyson yn cyrraedd cynulleidfa o gannoedd o ddisgyblion, sy'n golygu cost o lai na £2 i bob disgybl - cost resymol iawn o gofio'r profiad a'r mwynhad fydd y plant yn eu cael wrth ddysgu am eu hamgylchedd naturiol.

Wrth edrych yn ôl ar fy mhlentyndod, roeddwn i'n hynod o lwcus i gael fy magu ym Mae Cemaes, sef pentref ar arfordir gogledd Ynys Môn. Roedd y traeth a'r môr yn rhan bwysig iawn o'm plentyndod, a chredaf fod yr holl oriau a dreuliais yn yr ardaloedd hyn wedi creu'r diddordeb mewn natur, cadwraeth a'r awyr agored. Rwyf yn hynod o lwcus fod y diddordeb yma wedi arwain at yrfa yn y maes cadwraethol gydag Awdurdod Parc Cenedlaethol Eryri. Y gobaith yw, drwy gynnal y sioe bioamrywiaeth, medrwn ysbrydoli rhai o gadwraethwyr ac ecolegwyr y dyfodol. A hyd yn oed os na fyddwn yn llwyddo i wneud hynny, bydd y profiad yn gwella dealltwriaeth y disgyblion o'r amgylchedd naturiol a rhyfeddodau bywyd gwyllt o'u cwmpas, ac o'r herwydd yn sicrhau dyfodol mwy llewyrchus a chynaliadwy i'r ardaloedd arbennig hyn.

Mae cyfle i bobl gymryd rhan yn y prosiectau yma. Os oes gennych ddiddordeb, mae croeso i chi gysylltu â Swyddog ACA Alison Hargrave am fwy o fanylion (alisonpalmerhargrave@gwynedd.llyw.cymru).

*Mae **Gethin Davies** yn gweithio i adran Cadwraeth, Coed ac Amaeth Awdurdod Parc Cenedlaethol Eryri. Os dymunwch gysylltu â Gethin, ffoniwch 01766 772 255 neu gyrrwch e-bost i g.davies@eryri-npa.gov.uk.*

Cyfeiriadau

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Snowdonia - more than mountains

2016 will be the fifth year of the Annual Biodiversity Tour around Eryri's schools. Past themes have included soils, woodlands, freshwater environments and dark skies. This year the focus will be on the marine environment. Eryri's coastline is both beautiful and internationally important. All 37 miles of it forms part of the rich and diverse Pen Llŷn a Sarnau Special Area of Conservation.

In June pupils from three coastal primary schools will have an opportunity to learn about nature on their doorstep, through a range of activities that will also demonstrate the interdependency between various sectors and industries – and ultimately how they are all reliant on a clean, healthy and biodiverse marine ecosystem.

Matt Hobbs

Do bats visit the Pembrokeshire Islands?

Skomer island off the Pembrokeshire coast

New ideas about the movements bats will undertake in the UK are emerging, as we discover that bats such as Nathusius' pipistrelle make extraordinary journeys. Here ***RACHEL TAYLOR*** *reports on a research project recording the occurrence of bats on three Pembrokeshire islands, to look for evidence of bats commuting to these sites. Far more bats were found than previously known there, including unexpected species such as greater horseshoe bat.*

There are 17 resident species of bat in the UK which are known to form maternity colonies. A further eight species have been recorded as vagrants/occasional visitors. There is currently little information available on the migratory behaviour of UK bats, although three species which are thought to be capable of undertaking long-distance migration within Europe breed here (noctule *Nyctalus noctula*, Leisler's bat *Nyctalus leisleri* and Nathusius' pipistrelle *Pipistrellus nathusii*). There is a growing body of evidence to suggest that some bat species which have traditionally been thought to be resident and non-migratory in the UK, may actually be migrating into and out of the country. Much of this evidence has come from records of grounded bats on ferries and oil rigs offshore and also at coastal sites.

During 2012-2014, BSG Ecology carried out a number of studies to investigate whether bat migration was occurring in the UK. The research was stimulated by the professional and personal interest of the team, which had developed as a result of bat survey work on some large sites on the east coast of the UK in recent years. The data from these east

coast studies showed seasonal changes in bat communities which could be caused by migration. We decided to investigate this further, by deploying bat detectors at nine locations around the UK coastline for several months in 2012, 2013 and 2014, including the Pembrokeshire islands of Skokholm, Skomer and Ramsey.

We also deployed detectors on two offshore ferries in the southern North Sea – *Flandria Seaways* (DFDS freight) sailing between Felixstowe and Vlaardingen, and *Pride of York* (P&O ferries) sailing between Hull and Zeebrugge. As early results showed seasonal changes in bat activity at coastal sites, we carried out stable isotope analysis in 2014 on fur samples from 25 Nathusius' pipistrelles caught in the UK.

The bat detector studies showed that Nathusius' pipistrelle activity peaked in spring and autumn, which may be evidence of migration. The stable isotope analysis suggested that at least 40% of the bats had moved a long way since moulting the previous summer, and may have come from northern or eastern Europe. Nathusius' pipistrelle was recorded by the ferry detectors in the middle of the North Sea between Hull and Zeebrugge.

On Welsh Islands

In spring 2014 BSG Ecology deployed bat detectors on Skomer, Skokholm and Ramsey, which lie between 0.8 km and 2.6km off the west coast of Pembrokeshire. The islands are open and isolated from good bat habitat, and we assumed that baseline bat activity of resident bats was likely to be low, allowing us to pick up any seasonal changes due to the arrival and departure of transient or migratory species. From here there is a relatively short crossing to Ireland (Ramsey is approximately 76 km ESE of Wexford). It follows that if bat migration between Britain and Ireland occurs, then the islands may be the first arrival or departure point for bats crossing between the two.

Wardens collect bird migration data in both spring and autumn, as the islands are on known bird migration routes. They were able to help us collect bat data throughout the period when bats are active. There was little prior information about the

Matt Hobbs

Nathusius's pipistrelle *Pipistrellus nathusii*

diversity, abundance and seasonality of bats on the three islands, with low numbers of bat records existing for each, so the project was able to help fill this gap.

Finding the bats

In 2014 bat detectors (AnaBats) were deployed at Ramsey (2 May-13 November, 172 nights recorded), Skokholm (4 May- 24 October, 67 nights recorded) and Skomer (23 May-24 October, 121 nights recorded).

The detectors were protected by a waterproof case and attached to an external 12v battery, and the microphone was housed within a section of curved piping in order to waterproof the unit. The microphones were installed in sheltered locations on each island, at approximately 4 metres above ground level. Each detector was set to record continuously from 30 minutes before sunset to 30 minutes after sunrise.

At each location the wardens were trained by a BSG Ecology staff member to collect recordings and to maintain the AnaBat unit. Data were sent to BSG on a weekly or fortnightly basis for analysis using Analook software, and exported into a spreadsheet in order to interpret the recordings. In the analysis we use bat passes per night (B/n) or bat passes per hour (B/h) to describe relative activity levels. For the two species of long-eared bat and for species of the genus *Myotis*, bat calls were grouped together (as long-eared spp. or *Myotis spp*. respectively) because

of overlapping call parameters, making species identification problematic.

Findings

We were able to draw some interesting conclusions from these data. We learned that bats were regularly using the islands, and that some species may be resident, whilst others commute from the mainland. Bat activity on each of the islands was different, which could be linked to the distance between the islands and the mainland. We also observed that bat activity on the islands varied according to the seasons.

Over the survey period the three detectors returned a combined total of 21,266 bat passes (of which nine passes were unidentifiable) from 360 survey nights. A minimum of nine species (common pipistrelle *Pipistrellus pipistrellus*; soprano pipistrelle *Pipistrellus pygmaeus*; Nathusius' pipistrelle; noctule; Leisler's; *Myotis spp.*; long-eared bat spp.; barbastelle *Barbastella barbastellus*; greater horseshoe *Rhinolophus ferrumequinum*) were recorded at Skomer and Ramsey and seven species at Skokholm (barbastelle and long-eared bat spp. were not recorded). *Myotis* species were not separated to species level, therefore it is possible that more than one *Myotis* species was recorded.

Skokholm

A total of 1,034 bat passes were recorded on Skokholm.

Species	Av. B/n	% of overall recorded activity
noctule	9.3	60
noctule / Leisler's	5.9	38

The second highest activity levels had parameters overlapping between noctule and Leisler's bat and therefore could have been either species. Overall, 98% of bat passes were from bats of the Nyctalus genus. In September bat activity increased to 46.5 B/n with the majority of recorded passes from Nyctalus spp. (noctule = 28.1 B/n; and noctule / Leisler's bat = 17.8 B/n). There was also an increase in species diversity with at least seven species recorded in September. A maximum of three species were recorded during the other months.

Skomer

On the larger island of Skomer, 5930 bat passes were recorded, with the highest activity rates for common pipitrelle, soprano pipistrelle and noctule. Activity rates of all other species were relatively low. Eight Myotis sp. passes were recorded between July and October. Nathusius' pipistrelle and barbastelle were recorded once each, in mid-September.

Species	Av. B/n	% of overall recorded activity
common pipistrelle	30.4	62
soprano pipistrelle	7.1	14.5
noctule	6.9	14
Long-eared bat spp.	0.9	
Leisler's	0.4	
greater horseshoe	0.2	

Ramsey

The greatest level of bat activity was on Ramsey, where a total of 14,308 bat passes were recorded. By far the highest activity rate was recorded for common pipistrelle at 95%, with rates for all other species relatively low.

Species	Av. B/n
common pipistrelle	79.1
soprano pipistrelle	0.7
noctule	0.6
Myotis spp	0.6
Long-eared bat spp.	0.4
greater horseshoe	0.3

Four Leisler's bat passes were recorded between August and September. Nathusius' pipistrelle was recorded twice in September and once in October, and two barbastelle passes were recorded at the beginning of July and mid-September.

All of the islands recorded a peak in bat activity in September: Ramsey 228.4 B/n; Skomer 149.2 B/n; and Skokholm 46.5 B/n. High levels of bat activity were recorded also on Ramsey in May (103.9 B/n). The detector on Skokholm was not running for this period and the detector on Skomer started recording on 23 May, and therefore may have missed this peak in bat activity. On Skomer there was a small peak in activity in July (62.2 B/n) prior to the main peak in September.

JeanRoulin CC-SA 3.0 Unported

Barbastelle bat *Barbastella barbastellus* Ystlum du

Meaningful results

This study has provided improved knowledge of the diversity, abundance and seasonality of bats on each of the Pembrokeshire islands. The data collected suggest that the islands, which were originally considered to be relatively unsuitable for bats due to a lack of foraging and roosting habitat, shelter, and distance from the mainland, are regularly used by a variety of bat species. They also provide evidence that several species of bat may roost on the islands, particularly Skomer and Ramsey, for at least part of the year.

One of the more unexpected results was the use of the islands by two species, greater horseshoe and barbastelle, which generally stay close to habitat features when commuting or foraging and are thought to avoid crossing large open spaces. Greater horseshoe bats were recorded on all of the islands in all months of the survey period on Ramsey, in July and September on Skomer, and in September on Skokholm. The records from each island suggest that this could be regular behaviour and that bats may be commuting to the islands nightly or roosting in sea caves – possibly prior to hibernation. Barbastelles were recorded three times; in July and September on Ramsey and in September on Skomer. The low sample size makes interpretation difficult but it is clear that this species will cross the open sea to reach the islands.

A peak of activity was observed in the late summer/autumn for species that are known to be long distance migrants in Europe. The timing of the records may indicate a number of things: migratory behaviour; post-breeding dispersal of bats; or, bats exploiting a seasonal abundance of a particular prey species on the islands. The data do not prove that bats are migrating within the UK, or between the UK and Ireland, but it does provide evidence that this may occur. Further research in this area will be necessary to provide a more definitive answer.

***Rachel Taylor** is a Consultant Ecologist at BSG Ecology, Monmouth. She specializes in bat and other protected species survey and assessment.*

Acknowledgments

We would like to extend our thanks to the RSPB and South & West Wales Wildlife Trust and their respective wardens for helping us to complete this project on the islands.

Full details of the methods, analysis and results are included in the Pembrokeshire Islands Bat Report, which can be found on the BSG Ecology website **www.bsg-ecology.com** together with further information on the BSG Ecology bat migration project.

A oes ystlumod yn ymweld ag Ynysoedd Sir Benfro?

Mae presenoldeb ystlumod ar lwyfannau olew a fferiau yn awgrymu eu bod yn fwy mudol nag yr oeddem yn ei gredu o'r blaen. Gosododd BSG Ecology synwyryddion ar ynysoedd Sir Benfro i brofi'r theori mai yma fyddai glanfeydd cyntaf ystlumod sy'n hedfan o lwerddon. Datgelodd y rhain gyfnodau o brysurdeb tymhorol, ac amrywiaeth syfrdanol o ran rhywogaethau. Er nad yw hyn yn brawf o lwybr ymfudo, mae'n dangos y gall yr ynysoedd ddarparu cynefin addas o ran clwydfannau a bwyd ac nad yw'r ystlumod yn ofni croesi dŵr agored.

"I had seen nothing in nature so spectacular"

The Grassholm saga

R M Lockley, Grassholm 1946

The fourth largest gannet colony in the world and, as ***DAVID SAUNDERS*** *reports, a very remarkable tiny island.*

Greg & Lisa Morgan

Ronald Lockley made his first visit to Grassholm in July 1928 when he and Doris spent a night on the island during their honeymoon. In a vivid description of the natural history, and especially the gannet colony, he wrote "I had seen nothing in nature so spectacular, a ballet in blue and silver"[1]. Twenty-two acres in extent and rising to 146 feet, Grassholm lies seven miles due west of Skomer and is part of a volcanic ridge extending from the Marloes Peninsula. The last fragment above sea level, 18 miles from the mainland and the most westerly land in Wales, is the reef on which the Smalls lighthouse stands.

The Tudor antiquary John Leland described Grassholm as "a good way into the se, and is but smalle and without habitation"[2]. In the past, ownership of Grassholm was usually combined with that of Skomer, Middleholm and Wooltack Point. All changed in 1937 when the island was sold to Martin Harman of Lundy, who purchased it for his son

Part of the immense colony of Puffins on Grassholm 1893

John, later to be awarded a posthumous Victoria Cross for his bravery at Kohima in 1944. Next was Malcolm Stewart, an ardent naturalist and enthusiastic visitor to gannet colonies. In 1947 he sold the island to the Royal Society for the Protection of Birds for £500.

Early inhabitants

The *Mabinogion* may be full of magical tales, giants, beautiful women and heroic men but it tells of seven who lived on Grassholm for 80 years. The first documented archaeological discoveries date from 1890 when T.H. Thomas and T.W. Progar made a small collection of pottery, flint flakes and burnt stones, while noting distinct traces of structures or enclosures[3]. In July 1956 Lockley discovered the remains of a large stone-walled enclosure. This had previously been obscured by the matted maritime grassland, chiefly red fescue *Festuca rubra*, which dominates the island outside the gannet colony. Surmising that gannets had nested in the past, he thought it almost certainly a corral or catching pen into which plump, flightless gannet chicks could have been herded and then killed. Douglas Hague of the Royal Commission of Ancient and Historical Monuments of Wales made a rough plan of the enclosure during a brief visit in 1963, and in 1972 he spent five days ashore. Discovering more than the single enclosure, he concluded there had once been a small farming community. Aerial photography in 2001 and 2011 showed more unrecorded earthworks, walls and buildings. A subsequent ground survey in October 2012 confirmed there had been a much more extensive settlement than previously realised. The stone-built round-houses, cairns and field boundaries suggested occupation of the island in prehistoric times. A large part of the island surface, including the enclosure noted by Lockley, is now obscured by gannet nests.

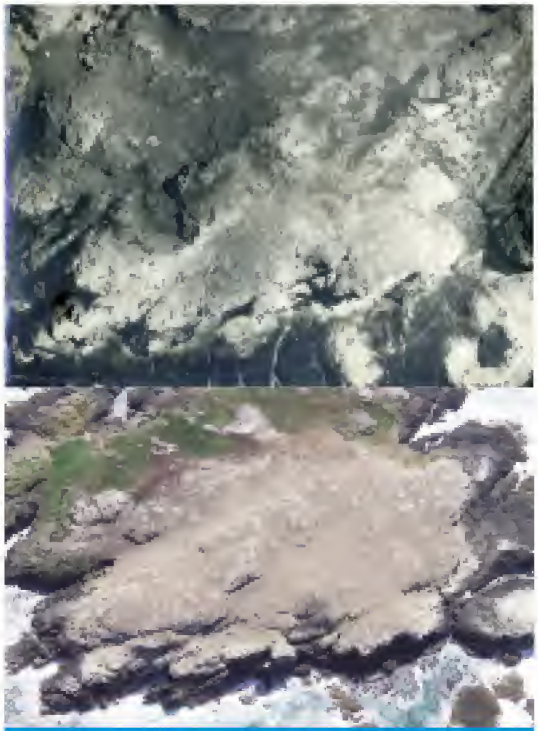
The rise and rise of the gannet colony

Both Gurney[4] and Lockley met Pembrokeshire fishermen whose grandfathers remembered gannets nesting on Grassholm as far back as 1820. Forty or so years on, eggs from the small colony "were greatly prized", while the first count of just 20 nests was made by E Lort-Phillips in 1883. At least 200 pairs were nesting when members of the Cardiff Naturalists' Society, under the leadership of the Cardiff trawler owner J. J. Neale, arrived to camp at the end of May 1890. The following day their solitude was shattered when a party of army and navy officers arrived and began dragging puffins from their burrows and killing them with sticks, while three "in the costume and with the accent of gentlemen"[3] were throwing gannet eggs over the cliffs. A report in *The Daily Graphic*[5] prompted a question in the House of Commons where it was mistakenly claimed that the Bird Protection Acts did not extend to the island. In Haverfordwest Court on 9th August 1890 the seven defendants were each fined £1 16s plus costs, a total of £22 17s. This was the first such case brought under the Wild Birds Protection Acts of 1880 and 1881.

Following the First World War Vivian Hewitt, millionaire, pioneer aviator and avid collector of avian specimens, visited Grassholm on 30 May 1922, having travelled by motor launch from Gower. He estimated the colony at between 800 and 1,000 pairs and concluded his account as follows: "At 7.30 p.m. we got under way, and reluctantly turned our backs on Grassholm. Looking back we saw the racing tide creaming round Grassholm's rocky base, the sun bathing the rocks in its red glow, and above all the gannets wheeling and fishing. It was a sight given to few to behold, and one which will live long in my memory."[6] Two years later, Acland and Morrey Salmon reached Grassholm after rowing for nine

RAF, courtesy David Saunders

S. Murray



Gannet colony, top 1949, bottom 2015

miles in a blazing breathless calm. Their photographs revealed some 2,000 pairs were nesting. Having waited a week before setting out, their concluding words highlight the problems of reaching the island: "It was unfortunate that the weather was responsible for giving us so short a time ashore, but we could not stay longer and risk being marooned for an indefinite time; as it was, from the time of our first embarkation at 1.30 a.m., from which after a couple of hours, the weather forced us to put back and make a second start at 10.30 a.m., to finally reaching the mainland on our return at 10.30 p.m., we spent eleven and a half hours in the boat."[7]

On 9 June 1930 an area of deep peaty dry grass on Grassholm was found to be on fire. Volunteers from Skokholm, Skomer and St David's found the task of extinguishing it beyond them. Fortunately a Royal Navy cruiser squadron was anchored in Dale Roads so a request for help was made to the Admiralty. Destroyers were dispatched and the fire was eventually checked by means of a deep trench dug by sailors. Some days' later, rain now having arrived, the navy reported that "The gannets looked happy though damp!" By 1933 photographs showed the colony had increased to 4,750 pairs. The following year, Lockley and Julian Huxley camped on Grassholm with a cameraman from London Films to film the gannets. The result, *The Private Life of the Gannet*, so named because Alexander Korda had recently had success with *The Private Life of Henry VIII*, became the first wildlife film to receive an Academy Award. It received a longer applause at its premiere in Leicester Square than the accompanying *Scarlet Pimpernel*! What seems incredible now was that in the summer of 1945 thte United States Army Air Force used Grassholm as a bombing target. A

Greg Morgan

flurry of letters to *The Times* and an appeal to the Air Ministry brought about a speedy halt to a potential catastrophe. In 1949 the colony was counted from aerial photographs, the first time this technique was used here. John Barrett, then in his third year as warden of the Dale Fort Field Centre, examined the photographs and found 9,200 pairs. All subsequent surveys have used this technique; the most recent, in 2015, reported 36,011 apparently occupied sites (AOS)[8].

In recent years miniature tracking devices attached to immature Grassholm gannets by scientists from Exeter University have shown that they roam great distances, even visiting other colonies in France, Ireland and Scotland. In contrast, breeding adults mostly forage up to 230 miles west and south-west of the island and do not visit other colonies[9].

The fall and fall of the puffin colony

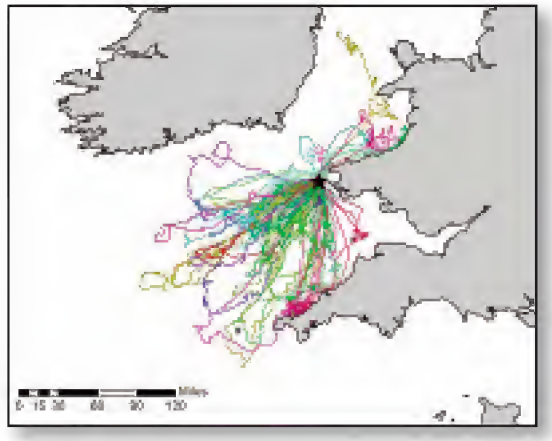
Early naturalist visitors to Grassholm all remarked on the immense numbers of puffins. Lort-Phillips who camped in 1883 described how "the puffins were there in their thousands (I don't think I am pulling the 'long-bow'). We were hard put to find a bit of ground clear of puffin-burrows on which to erect our very small tent." Thomas, in his graphic account of the visit to Grassholm in 1890 by the Cardiff Naturalists' Society, described their arrival as follows: "With our multifarious belongings we

Table 1: Recent estimates of the numbers of birds breeding on Grassholm

European storm petrel	AOS	5
Gannet	AOS	36,011
Shag	AON	22
Lesser black-backed gull	AON	27
Herring gull	AON	27
Great back-backed gull	AON	11
Kittiwake	AON	23
Guillemot	Indivs	1,849
Razorbill	Indivs	53
Oystercatcher	Pairs	5
Raven	Pairs	1
Rock pipit	Pairs	2-3

***AOS = Apparently occupied sites;**
AON = Apparently occupied nests;

Gannet foraging



scrambled up the rocks above the tiny landing-place on the island. We stumbled along among stones and puffin burrows to a spot where one of the sailors told us was the only camping ground. ----- During the night there had been inexplicable croakings in our tent, these were now explained by the appearance of some puffins hopping in a bewildered manner from the tent which was pitched over their burrows"[3]. Three years later Robert Drane FLS, another Cardiff stalwart – described on a memorial tablet at his former shop in Queen Street, Cardiff as a "naturalist, antiquary and connoisseur", to which could justifiably be added 'character' – camped on Grassholm. He described the vast numbers of puffins. Calculating the area of the island in square yards and allowing two puffins to each he arrived at a total of 689,638 birds, but by no means all the island is suitable for the burrow-nesting puffin. Recalculation suggests the colony to have been about 100,000 pairs, still immense when one considers the size of the island. Forty years later just 130 pairs remained. By the early 1960s there were just two or three pairs and none have nested since the 1970s. The extinction of the Grassholm colony seems to have been due to the collapse of the burrows in the soft *Festuca* peat, resulting in a sun-baked puffin Pompeii.

Other breeding birds, transient visitors and seals

Since 1934 all breeding species, in addition to the gannets, have been counted at varying intervals. Table 1 shows the most recent figures. As well as gannet and puffin, other seabirds have undergone dramatic changes. Herring gulls reached a peak of

500 pairs in 1973 but now number less than 50. Kittiwakes, for several decades since the first count in 1934, ranged up to 150 pairs in 1972 but declined to just 23 in 2012. On the plus side the most dramatic change concerns guillemots. As on Ramsey, Skokholm and Skomer they have greatly increased from a low of no more than 60 individuals in 1973 to 1,849 at the last census in 2012.

Williams[10] listed 72 species seen on Grassholm, in addition to divers, sea-duck and non-breeding seabirds. These include turnstones which are probably resident for most of the year. Migrant butterflies like red admiral and clouded yellow have from time to time delighted visitors to the island. Grey seals are always present, sometimes in numbers up to 120, though the absence of a beach and virtually no place to haul out means that pups are rarely if ever born here.

Visiting Grassholm

In the past one could freely land on Grassholm, weather permitting, but the dramatic expansion of the gannet colony means this is no longer possible. Several boat operators offer visits to view the island, to experience the sight, the sound and the smell of one of the most exciting wildlife spectacles in Wales, an experience not to be missed. The RSPB warden based on Ramsey has responsibility for Grassholm and reaches the island on about ten occasions each year.

Acknowlegements

I am most grateful to Greg Morgan RSPB warden of Ramsey and Grassholm for answering my questions and checking my text at an extremely busy time of year.

David Saunders *made the first of many visits to Grassholm in 1960. He was for many years honorary warden of the site.*

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Huganod ar Ynys Gwales

Mae nythfa huganod ynys greigiog Gwales wedi bod yno ers amser maith, a cheir atgofion am nythod mor bell yn ôl ag 1820. Yn 1883 dim ond 20 nyth a gofnodwyd yno ond erbyn 2015 roedd mwy na 36,000 ohonynt yn gorchuddio hanner yr ynys. Ar y llaw arall, mae'r nythfa anferth o balod a gofnodwyd yn 1883 wedi diflannu'n llwyr, a hynny, o bosibl gan fod eu tyllau wedi dymchwel yn y mawn meddal. Ceir olion o anheddau dynol, gan gynnwys yr hyn a allai fod yn gorlan lle roedd cywion na allai hedfan o bosibl yn cael eu crynhoi ar gyfer eu lladd, ond mae llawer o'r rhain bellach wedi eu gorchuddio â'r nythfa o huganod.

Greg Morgan

Approaching Grassholm, the gannet colony clearly visible

Elain Gwilym/NRW

Freshwater pearl mussels

Pearls in Peril

The ponds in full filtration phase

***Natur Cymru 50** reported on the beginnings of the Pearls in Peril project which was aiming to protect vulnerable populations of freshwater pearl mussels on the Afon Eden. As the project draws to its close **ELAIN GWILYM** and **JACKIE WEBLEY** report on the work that has been done. Things are looking hopeful, but it may be many years before we see how successful it has truly been.*

The Afon Eden Special Area of Conservation (SAC), around Trawsfynydd, is home to one of the longest-lived invertebrates and also one of the most critically endangered species in the world, the freshwater pearl mussel *Margaritifera margaritifera*. Incredibly, these bivalves can live for more than 100 years and grow as large as your hand. They live at the bottom of clean, fast-flowing, nutrient-poor rivers, where they can be completely or partly buried in coarse sand or fine gravel.

They are in decline worldwide due to:

- Habitat degradation caused by sedimentation of river gravel
- Historic pearl fishing
- Pollution, sedimentation and water quality deterioration
- River channelization work
- Change in riparian land use

'Pearls in Peril' (PIP) is a UK-wide LIFE nature project which aims to safeguard the future of important populations of freshwater pearl mussels. The project started in 2012 and will be completed in 2016. In

Initial stage of pond being dug.

Wales the work has concentrated on the Afon Eden Special Area of Conservation (SAC) catchment, around Trawsfynydd, where much has been done to restore river habitat and provide education about freshwater mussels to the local community and other stakeholders.

Brynteg Forestry Block

Brynteg forestry block is believed to negatively affect the Eden through the input of sediment and nutrients. The site covers an 88 ha block in the centre of the Eden catchment and has been harvested in patches over the last 20 years, resulting in a mosaic of remnant wet woodland, commercial forestry, marshy grassland and bog habitats. It was planted after WW2 on unsuitable ground and peaty soils: drainage ditches were installed to improve conditions for commercial tree growth, but this meant that fine sediment could easily drain from the site and enter the Afon Eden. Silt covers the riverbed and blocks small gaps between the gravels and coarse sands, reducing the available oxygen that freshwater pearl mussels need to survive.

Activities such as afforestation, harvesting and road construction are a potential source of sediment and nutrients (particularly phosphorus) to rivers. Clear-felling does bring a higher potential for nutrient loss, and brash will also rot and release phosphorus and nitrogen into the ecosystem. The rate of decomposition is influenced by temperature, moisture and humidity, and this process can last for years.

Phosphorus loss is generally considered more significant than any other nutrient loss, and peaty soils have very little capacity to bind phosphorus. Where peat soil is adjacent to the watercourse the buffer zone is ineffective in binding phosphorus to the soil and in such situations will only operate through uptake by vegetation. It is critical to understand these sources and pathways of sediment and nutrient loss from the site to the aquatic zone if effective restoration is to take place.

Over the past three years, PIP has surveyed all the drainage ditches within the 88ha block and undertaken sampling in the Afon Eden, testing for levels of dissolved oxygen. This allowed us to identify the 'hot spots' where high levels of sediment were being transported into the main river, and via which drainage route. We have constructed 430 peat dams across Brynteg, with the aim of reducing the flow of water through the site and promoting the growth of sphagnum mosses to encourage water retention. This is a tried and tested method for peat restoration.

We have also constructed 11 settlement ponds, which have been planted with common reed to assist with nutrient removal from the water as it drains through the ponds and down to the Afon Eden. They have been strategically located and designed to retain the water for a period of 24-48 hours. Water quality monitoring has shown the ponds filter just under 60% of suspended solids from the water before it reaches the Afon Eden.

Monitoring

The project has established an extensive monitoring program on the Eden. The redox (reduction-oxidation reaction) sampling allows us to calculate the amount of oxygen that's available in the river bed, which is essential for juvenile mussels. If the riverbed has a heavy sediment loading it is likely to be unsuitable. The redox figure needs to be below 20% for juvenile survival.

The 2013 results, before any restoration work, showed a total of eight sites where dissolved oxygen levels were too low for juvenile mussels. By 2015, after the works, only one site remained unsuitable.

These results are encouraging and indicate that the ditch blocking and sediment ponds have had an almost immediate beneficial effect on the quality of riverbed habitat. But there is still more work to be done to get these mussels thriving!

PIP has also undertaken electro-fishing surveys to search for glochidia (freshwater pearl mussel larvae) on the gills of young salmonids (Atalantic salmon or trout). This is the first time this has been undertaken on the Eden, and the results showed a clear preference for mussel larvae to attach to trout as part of the first stage of the mussel's lifecycle. Survey results also showed that trout are the least abundant salmonid in the river, meaning that fish abundance and distribution may affect the success of the freshwater pearl mussel population.

To tackle this important issue PIP has restored 2.4km of riverbed habitat. Locally sourced clean gravels have been placed in tributaries of the Eden to provide spawning areas for trout, and large boulders with woody debris have been positioned in the river's main stem. This helps to stabilise the riverbed and create a diversity of flow patterns which allow areas of natural gravel and coarse sand deposition to develop. In turn, these can provide suitable habitat for juvenile pearl mussels, and shelter and spawning areas for trout and salmon.

We're not finished yet...

The A470 trunk road runs through the Afon Eden catchment and monitoring has identified a range of pollutants in the road drainage runoff. PIP partners Natural Resources Wales (NRW) and North and Mid Wales Trunk Road Agency (NMWTRA), with support from the Local Authority, are working to install interceptors at specific locations to trap road runoff pollution and prevent it from entering the river, making a positive contribution to improved water quality in the Eden.

The project has identified two fords where sedimentation is causing degraded riverbed habitat and the pollution risk is considered to be high. Within the time-frame of the project we intend to install a bridge over one of the fords and set in motion works for a second bridge to eliminate these two problem areas.

It will be many years before we see the long term legacy of the project, as pearl mussels are barely visible until they are about five years old and are very long-lived. The last population count was in 2011, where numbers were shown to have declined and nearly halved since the previous count in 2007.

PIP will undertake another population count in the summer of 2016 and will continue to implement post-works monitoring. There is still a lot to do but it's incredibly encouraging to see such positive monitoring results and to have such great support from partners and stakeholders.

__Elain Gwilym__ is Pearls In Peril LIFE+GB Afon Eden Project Officer with Natural Resources Wales. __Jackie Webley__ is Project Manager, Pearls in Peril LIFE+GB with Scottish Natural Heritage.

Misglod perl dŵr croyw

Mae'r prosiect Perlau mewn Perygl (PIP), a ddechreuodd yn 2012, bellach wedi cwblhau ei waith adfer yn nalgylch Afon Eden yng Ngwynedd. Roedd gwaith draenio mewn coedwig gyfagos wedi cynyddu lefelau gwaddod a maetholion yn y cyrsiau dŵr, gan niweidio gwelyau graeanog y nentydd sy'n hanfodol i fisglod perl dŵr croyw. Drwy greu argaeau a phyllau gwaddodi mae PIP wedi helpu i lanhau'r dŵr a chodi lefelau ocsigen. Gan fod misglod yn tyfu mor araf efallai na welwn unrhyw gynnydd am rai blynyddoedd, ond hyd yma mae'r canlyniadau yn edych yn addawol.

ABOUT PIP

"Pearls in Peril" is a Life+ Nature project co-ordinated by Scottish Natural Heritage aiming to safeguard the future of important populations of freshwater pearl mussel. It is co-funded by 22 organisations across Britain and the European Commission, with a total budget of £3.5m. More information and downloads are available on the PIP website: www.pearlsinperil.org.uk and you can follow the project on Twitter and Facebook.

Green **Bookshelf**

Meadowland
John Lewis-Stempel
Black Swan 2015
Softback £8.99
293 pages

In summer a meadow can personify paradise. Now most of them have become green parking lots for livestock. They have slipped away from human experience, but still they stir the imagination. So this diary of the private life of an English field is a well-timed opportunity for us to visit John Lewis-Stempel's meadowland, and see it through his eyes.

His patch is on the western fringe of Herefordshire, close to the Welsh border – to Offa's Dyke and the Golden Valley. His lineage is part Welsh, and he delves into the derivation of words including Welsh ones; indeed his love of words, of names, and the curiosities of history is everywhere revealed. The diary is seasoned with well-chosen quotes and surprising facts about rural life and his own. At the heart, though, is one man's love affair with his land, and the discoveries of how much wildlife there is in his meadowland throughout the year, whether observed as he crouches in a ditch with a gun in wind and snow or as he laboriously harvests hay with a scythe under the sun's 'steeping haze'.

Lewis-Stempel's instinct is to observe and write about nature 'from the hedge looking outwards', as Richard Mabey puts it. This he does with partial success, as the egalitarianism required for full sublimation to the meadow's heartbeat does not, I feel, come easily to him. Perhaps my only reservation about this wonderful, lyrical foray through the meadowland's seasons – and this is a minor one – is that he presents a level of expertise which I found hard to believe in. Early on he notes 'stands of thistles of a density which suggested remarkable ancestry.' Thick stands of thistles are more likely to indicate past manure heaps. Look for the absence of stands of any one species to indicate ancient grassland.

You may find, as I did, a number of statements to question, but this will not diminish the pleasure of this literary visit to a meadow through the year. It should only strengthen your resolve to work for the survival of those fields which still have their full complement of nature intact, including grasses and herbs and buzzing and gliding insects. I look forward with enthusiasm to reading Lewis-Stempel's new book *The Running Hare – the secret life of farmland*.

James Robertson

Field Guide to the Bees of Great Britain and Ireland
Steven Falk, illus. Richard Lewington
British Wildlife Publishing 2015
Paperback 336 pages, RRP £35

The latest in the excellent British Wildlife series, *Field Guide to the Bees of Great Britain and Ireland* has been eagerly anticipated by the entomological world. Whilst there are several contemporary books and guides on bumblebees, and a short article on leaf-cutter bees was published in *British Wildlife* in 1999, we have been bereft of any modern account of British bees. The last accounts which provided keys to identifying just a proportion of the fauna were published almost 100 years ago, and those wishing to identify British bees have had to rely on unpublished literature or on books covering the European fauna. This has been an extraordinary omission considering the importance of bees from a conservation, ecological and economic perspective.

Lavishly illustrated with over 700 colour photographs and over 1000 colour and black & white artworks, including 20 beautiful plates by Richard Lewington, the book provides detailed accounts and maps of all 234 bee species. There are short opening sections on how to distinguish bees from other Hymenoptera and fly mimics, bee classification, their life cycles, and the many enemies and associates of bees. Seventy-three species of British bee are cleptoparasites, laying eggs in the nests of other bees with the developing larvae feeding on the host's eggs, larvae and pollen store. There is a thorough review of the habitats used by bees, amply illustrated with habitat images, and sections on field techniques and recording and the conservation of bees. It may sound a little contradictory, but many species have to be collected and identified using a microscope to confirm identification, although there are a growing number of images available on the internet to help identify some of the more easily identified bees.

The bulk of the book (355 pages) is devoted to identification keys and individual species accounts. The species accounts follow a standard layout with sections on appearance and how to separate from similar species, variations in size and colouration, flight period, nesting habits, habitats and flowers used by the bee, the hosts of cleptoparasitic species, an assessment of current status and distribution, and a distribution map. The identification keys are clear and well illustrated and I have used them to identify species of *Halictus*, *Hylaeus* and *Lasioglossum* with some success. There are areas of doubt for the novice – assessing the degree of punctuation is not always straightforward! – but experience and familiarity should help to resolve these with regular use.

I thoroughly recommend this book, which will be the standard reference for the foreseeable future, to all those with a passing interest in insects, as it provides the most easily accessible account of the ecology and distribution of all British bees. The keys will hopefully encourage more entomologists to record species with greater accuracy and help to provide improved information on status and distribution, essential in the understanding of population trends in some of our most important pollinators. If you're going to use the book regularly, either in the field or in the identification of voucher specimens, treat yourself to the hardback format.

Mike Howe

PRIFYSGOL BANGOR

MSc / MA Rheolaeth Amgylcheddol Gynaliadwy

Diddordeb yn ein dyfodol?
Chwilio am waith ym myd cadwraeth a'r amgylchedd?
Angen hwb i'ch gyrfa?
Am astudio drwy gyfrwng y Gymraeg?

Mae'r cwrs meistr cyfrwng Cymraeg unigryw hwn wedi ei anelu at fyfyrwyr sydd â diddordeb gwirioneddol mewn datblygiad cynaliadwy a materion amgylcheddol.

Manylion Pellach
Am wybodaeth bellach cysylltwch â'r canlynol yn Ysgol yr Amgylchedd, Daearyddiaeth ac Adnoddau Naturiol, Prifysgol Bangor, Bangor, Gwynedd, LL57 2UW.

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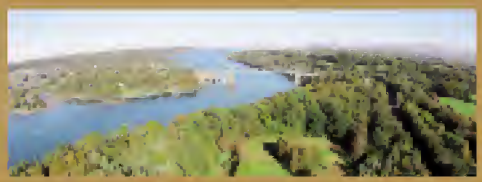
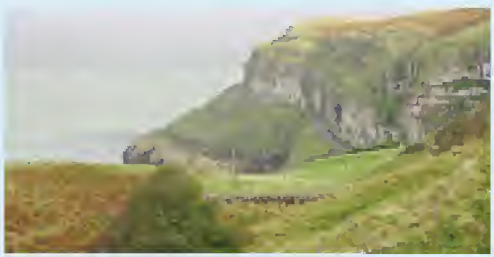


News update from the Great Orme

The National Trust is seeking a tenant for Parc Farm on the Great Orme to achieve the necessary grazing of its coastal limestone grasslands and heaths. The Trust is looking for a "very special person" with excellent shepherding skills, prepared to work hard and share their experience with the Great Orme's many thousands of visitors. The management needs of Great Orme's special habitats require a nature-first approach which may go against the grain of some modern farming methods. This is reflected in the farm business tenancy being offered at only £1 per annum. The wild plant charity Plantlife is also involved (see page 51 of this issue) and probably will be buying the sheep which are needed to graze the Great Orme.



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'Seared Scallops'

This item is not about methods of cooking in up-market restaurants where menus offer the adductor muscles of *Pecten maximus* (great scallop) prepared in various ways. Rather, it arises from the Welsh Government consultation (Autumn 2015) about scallop dredging in Cardigan Bay. The resulting clash between a commercial fishery and marine conservation generated much heat but rather less light. At the heart of the matter was whether scallop dredging was appropriate within any part of the Cardigan Bay SAC. The glacially slow and erratic progress in designating properly protected Marine Conservation Zones in Welsh waters has meant that any form of Marine Protected Area designation is sometimes seen as a substitute. However, the original Habitats Directive regulations were designed to protect particular features and not to control pre-existing activities where they did not clearly impinge on the listed features. There was also uncertainty whether Environmental Impact Assessments would be required, even if certain fisheries required consents to be issued.

The more challenging aspects of the issue concern seabed disturbance by the gangs of toothed dredges used to harvest scallops, and the rates of recovery of the benthos of different types of seabed. There is little doubt that this fishing method is one of the most destructive. Overturned stones reflect the oblique beams from side-scan sonar, and the tracks often show with enough clarity that the number of dredges on each gang bar can be counted. The initial damage is clear, but opinions vary as to the rates of recovery to something approaching normal conditions. Views are partly coloured by differing familiarity with the ecology of various seabed habitats. There is a long history of studies of those sandy and muddy benthic communities that are amenable to sampling by grabs. Equally, in the last few decades there has been greatly increased understanding of the fauna on sub-littoral bedrock accessible by diving. Substantial areas of seabed around Wales, typically at depths of 20-70m, come in neither category, being covered in a mixture of coarse lag gravels. The extent of these is well seen on the series of seabed sediment maps produced by the British Geological Survey in the 1980s. For their time these 1:250,000 sheets are remarkable documents. The Cardigan Bay sheet brought together a mine of information from dedicated BGS acoustic surveys and the work of geologists from Aberystwyth Univeristy and ocean scientists from Bangor.

Seabed dynamics in lag gravel areas

After the Devensian glaciation large parts of areas that are now seabed were left with a cover of glacial till. As sea levels rose, surf-zone erosion re-worked the till, often leaving an armouring veneer of stones and boulders. Once the sea became deeper than the surf zone, tidal currents carried sediments that partly filled crevices with finer gravel, shell fragments, sand and mud. The net result is a seabed that appears

Ivor Rees

Colony of *Nemertesia antenina* after being torn up by a trawl, showing the rootlet attachment which was holding sediment.

almost as if flattened by a road roller. Tidal currents still move sand and shelly grit, and if the sand starts to accumulate it forms ribbons, local patches and thin sheets over the lag.

It is not known to what extent colonies of sessile organisms, vulnerable to being torn away by dredges, can reduce the movement of these sand ribbons or sheets. One organism capable of doing this is a hydroid *Nemertesia antenina* (sea beard). The colonies, which can be 25cm high, are attached to the bottom with a mass of rootlets or hydrorhizae. When brought up by trawls and dredges the colonies often appear to have been trapping sediment. Although new stems may grow from a damaged colony, it is not known how long entire new clumps would take to grow, nor whether, under pristine conditions, there used to be enough such small biogenic features to influence the movement of sand and grit. The offshore mixed sediment and lag gravel seabed, where scallops have mainly been fished for, is still rather poorly understood in terms of sediment transport dynamics, biodiversity and ecological interactions.

Ivor Rees

There is life in dead wood!

Big old trees are amongst the largest and oldest organisms on earth and are capable of supporting a vast array of wildlife, especially in the dead and decaying areas of the tree. Dead and decaying trees and fallen dead wood provide a unique and dwindling resource for a variety of scare and highly specialised species, including a large number of invertebrates. This resource is often overlooked as a habitat but there are nearly 1800 invertebrate species dependent on dead wood in the UK, including over 700 beetle and 730 fly species[1]. This habitat is under threat and 17 of the invertebrate species dependent on decaying wood in the UK are listed as Priority Species of conservation concern[2].

Species dependent on dead wood are called saproxylic and don't necessarily feed on the wood itself. They could be feeding on the fruiting bodies within dead wood, feeding on sap runs, or nesting in the holes made in wood by other insects. Their dependency relies on anything from extensive seams of red rot in huge ancient trees, right down to small fragments of dead wood on the ground or sodden branches in water courses.

Welsh saproxylic invertebrates

Wales is home to hundreds of saproxylic invertebrates, including a number of rare and threatened species. The scarce cardinal beetle *Schizotus pectinicornis* is confined in Britain to Wales and Northern Scotland and is a Nationally Rare species. This attractive bright red beetle has larvae that are dependent on dead wood, preying on the larvae of other saproxylic species. The Welsh oak longhorn beetle *Pyrrhidium sanguineum* is another attractive red beetle found mainly in Wales. This rare beetle lays its eggs in newly cut timber, preferably oak; the larva feeds under the bark of dead branches and trunks before emerging as an adult two to three years later. There are also a number of other specialities including the weevil *Rhopalomesites tardyi*, the cranefly *Tanyptera atrata* and the Welsh clearwing moth *Synanthedon scoliaeformis* (see NC 48:26).

Threats

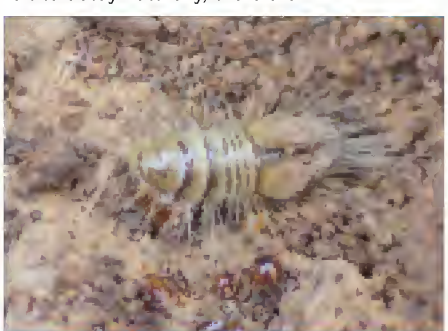
Despite its essential role in our ecosystems, dead wood is often seen as unsightly or unsafe and removed from areas, or taken for fuel. Another threat is the uniform age structure of many ancient trees, which means that while we may have a good resource for dead wood invertebrates on some sites at present, all of this resource may become too old at the same time. Trees are also often harvested before they reach their maturity and are not left to decay naturally, therefore limiting their use to saproxylic species. Another face threating these invertebrates is a lack of knowledge and understanding of their habitat: they are often hard to survey and there are few specialists who can survey them confidently, so species may be lost on sites before they are even discovered.

Conservation

If managed sympathetically, wood pasture and parkland habitats can contain a vast variety of saproxylic invertebrates with the dying trees forming an integral part of the landscape. Where safety is not an issue, trees should be left to decay naturally and fallen limbs left where they fall. On a smaller scale, creating dead wood piles in gardens, nature reserves and other local green spaces will provide a habitat for some specialist invertebrate species. Most adult saproxylic beetles and flies require nectar, so making sure that there is a supply of scrub and flowering plants nearby is also essential.

Ryan Clark

Ryan Clark



The cobweb beetle *Ctesias serra* is a widespread species in Wales,

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2. JNCC (2007). *UKBAP Terrestrial Invertebrate Species* http://jncc.defra.gov.uk/page-5169 accessed 06/05/16

Dancing to the rhythm of fungi

The sight of a fruiting ballerina waxcap *Hygrocybe calyptriformis* was once the cause of great celebration. In the 1990s and 2000s this uniquely pink variety of waxcap was considered a great rarity on grasslands across the UK and grant money was being given to people to both look for it and conserve it.

I know this because I sourced grant money from the Countryside Council for Wales when it was found for the first time on our Waun Las National Nature Reserve in 2005. This paid for an intensive re-survey of our waxcap-rich fields by Debbie Evans, some on-site interpretation, and waxcap identification training for budding new mycologists. It also helped me to understand and appreciate the importance of waxcap fungi on unfertilised grassland, the management needed to conserve it and the need to communicate this to others. In Wales, public interest and knowledge of waxcaps has clearly increased over the past 20 years, a consequence of a lot of advocacy by countless individuals and concerned organisations, including the National Botanic Garden of Wales.

I've seen for myself how much interest has been generated in waxcap fungi. Having plucked up the courage to run fungi forays at the Botanic Garden a few years ago, over 60 people turned up for one of my pre-advertised waxcap walks, and over the past three years David Mitchell has bravely taken on crowds of 40-50.

Old hat?

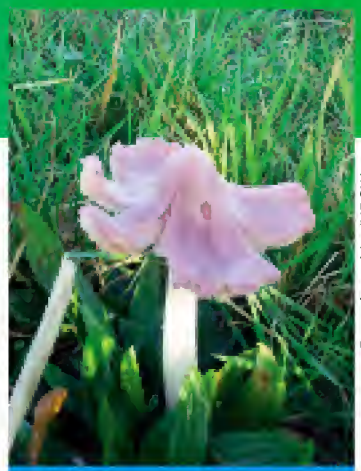
So why is the discovery of a new ballerina site not such a cause of celebration today? The rush to conserve this mushroom has had unexpected consequences. So many people were encouraged to look for it that there are now a few thousand records across the UK, with Wales and the west of England and Scotland having the most dots on the distribution map. Ballerina waxcaps, now officially referred to as pink waxcaps (I prefer the more romantic and evocative ballerina) are no longer on red data lists and have been superseded, from a conservation assessment point of view, by other rarer waxcap species.

However, that's not the end of the story. The distribution map on the National Biodiversity Network site shows that a large slice of western and northern Wales, from Fishguard up to Llandudno, has very few records of ballerinas. Maybe people haven't been recording so much there, but this indicates that ballerinas are still relatively rare.

On Waun Las NNR in autumn 2015 ballerinas were found fruiting in six different places, three more than we knew about before. They appear not just on our sheep-grazed pastures but on our traditionally managed hay meadows, and on our Wild Garden. Ballerinas have been fruiting for a longer period too, from late August through to early December.

So what's going on?

Could it be that the warm, wet autumn produced ideal weather conditions for waxcap fruiting? Possibly, but only 14 of all of our 22 known waxcap species here were observed to be fruiting.



Bruce Langridge/NBGW

Ballerina Waxcap
Hygrocybe calyptriformis

Could it be that our organic approach to farming is showing positive results? We've been managing our lands organically for over 15 years now, so perhaps our grasslands are gradually recovering from fertiliser applied before the Garden was established in the late 1990s. In 2015 we also found some of the more common, pioneering waxcap species, such as *Hygrocybe conica*, *H.virginia*, *H.pratensis*, *H.chlorophana* and *H.psittacina*, fruiting for the first time on fields that we know were definitely fertilised in the 1970s. This might be the key reason.

But let's not rule out human observation. Fungi are still hugely under-recorded in Wales compared to wildflowers, and the example of the growth of ballerina records is a perfect illustration of how our perception of conservation needs can change when we really look at what we have got. Ballerinas were one of the main reasons I became hooked on fungi and I suspect that they will continue to be a hook for future mycologists.

Bruce Langridge
Head of Interpretation, National Botanic Garden of Wales

Safeguarding the gems of a scientific collection

The mollusc collection at Amgueddfa Cymru–National Museum Wales is one of its natural history treasures and one that Wales can be proud of.

Molluscs are an extremely diverse group encompassing snails, slugs, bivalves and cephalopods. They exist in most environments on the planet – there are snails on Kilimanjaro, bivalves on Indian Ocean deep-sea hydrothermal vents, and carnivorous slugs in our gardens. Our extensive collection reflects this diversity and tremendous geographical and environmental range.

At the heart of the collection lies the Melvill-Tomlin bequest, a collection formed by two great British conchologists of their time. James Cosmo Melvill (1845-1929) started his shell collection in 1853 and during his life named over 1,000 species new to science. In 1919 he sold his collection to John Read le Brockton Tomlin (1864-1954) who continued to acquire important specimens from across the world until his death. This joint collection represents all regions of the world, and at the time of donation in 1955 it contained nearly half of all mollusc species known and over a million specimens. To give it a further accolade, it was the second largest shell collection to be held in private hands.

However, the Melvill-Tomlin collection does not stand alone. It is supported and complimented by thousands of other specimens from all over the world and together they form the second largest mollusc collection in the whole of the UK.

New discoveries are constantly made, particularly the discovery of what we call 'type' specimens. These scientific gems are the specimens carefully selected to represent new species and offer a permanent reference for future taxonomists. Within our Mollusca collection there are an estimated 3,200 type specimens, spanning over 200 years of collecting. Two-thirds of these come from the Melvill-Tomlin collection, further illustrating its scientific depth and historical importance.

Our earliest type is a large cold-water whelk from Alaska, *Neptunea lyrata*, collected in 1778 by Captain James Cook during his third and last voyage on the Resolution. This and many others were described by some of the great collectors and taxonomists of their time, including William Evans Hoyle, the Museum's first director and a world-renowned cephalopod expert.

AC-NMW

The holotype of a Blue-ringed Octopus first described by William Hoyle

Access for all

With many collection-based enquiries hinging on type material we wanted to develop a tool to make them accessible across the world and so the *Mollusca Types Catalogue* was born. The project began in 2009 when the focus was on isolating 350 of our most important types, which we stored in newly designated 'types' cabinets for easy access and increased security. All of these specimens and their labels were then photographed. The labels are in many ways as important as the specimens, as without them all provenance can be lost. Handwriting recognition is often key to identifying type specimens, so we felt it was vital that the user could see them too. Alongside the specimen data we recorded the references for original species descriptions and had them scanned. The *Mollusca Types Catalogue* was then published online for the first time in 2012: http://naturalhistory.museumwales.ac.uk/molluscatypes/

However, this is only the beginning and there is much work still to be done. The remaining types are gradually being added to the online catalogue and curators continue to discover previously unrecognised types within the collection. New type specimens are also being added when new species are described by our taxonomists; the type of the infamous ghost slug, first discovered in Cardiff, is just one example of this (see NC 33:44-5). Furthermore, scientists around the world continue to donate their type material to our collection for perpetuity.

This dynamic collection is a national treasure, with far reaching scientific and historical importance. It is a privilege for us to have custodianship of it at Amgueddfa Cymru–National Museum Wales.

***Harriet Wood**, Mollusc Curator, Amgueddfa Cymru–National Museum Wales*

Great Orme

When I took up my current post with Plantlife I spent a lot of time with my immediate predecessor Dr. Trevor Dines, and in our discussions I had to admit that I had never visited the Great Orme. Despite being brought up on the Wirral and my mother being part Welsh, we had always headed inland to the Halkyn Mountains, the Clwydian Range or the Dyfi Valley. Trevor both encouraged me to visit and said that I would fall in love with the place. He was right, of course.

The Great Orme, or Pen y Gogarth, is a carboniferous limestone headland which lies at the north-western tip of the Creuddyn Peninsula near Llandudno, rising to a height of 207 metres. Most of the site is managed by Conwy County Borough Council as a Country Park and Local Nature Reserve. The headland is of such importance that it enjoys, if that is the right word, multiple designations as a Site of Special Scientific Interest, of which 302 ha have additional European protection as a Special Area of Conservation. It also encompasses part of the Heritage Coast and in 2010 Plantlife declared it as an Important Plant Area, one of 24 found in Wales.

It's also an amazingly beautiful place to visit, with stunning panoramas, so it's understandably popular, attracting an estimated 600,000 visitors a year. Even on my first visit in November 2014 on a cold but clear day there were plenty of people clustered around the summit and taking in the view.

The predominant vegetation here is limestone grassland but pockets of heathland exist where soil of known glacial origin has accumulated. Areas of limestone pavement, scrub and woodland occur as well as high sea cliffs.

Since the early 16th century, the Great Orme was grazed by sheep and cattle, and by the 18th century was largely sheepwalk. Since the late 19th century, it has also supported a free-range herd of Kashmir goats, enough to exert some local grazing and browsing pressure but not enough to maintain the turf of the Great Orme in the absence of sheep. There are currently about 120 goats on the Orme and their numbers are being controlled if only to limit their impact on neighbouring Llandudno! The holder of the grazing rights for the unenclosed land on the Great Orme is permitted to graze up to 430 sheep but the numbers of sheep turned out on to the site has dwindled since the 1990s. The outbreak of Foot and Mouth in 2001 limited grazing still further and has had a lasting impact.

The lack of grazing is having a slow and deleterious impact on the grasslands and heathlands of the Great Orme.

The limestone grasslands are mainly distributed amongst two National Vegetation Communities, CG1 (*Festuca ovina-Carlina vulgaris* grassland) and CG2 (*Festuca ovina-Avenula pratensis* grassland) and are characterised by a short species-rich turf of sheep's fescue and herbs such as wild thyme, salad burnet and bird's-foot-trefoil. Smaller areas of taller, ranker swards on deeper soils are dominated by upright brome and by downy oat-grass. The limestone grasslands persist where livestock, principally sheep graze in association with rabbits and in some areas feral Kashmir goats, but where grazing has become

All photos: Colin Cheesman/Plantlife

The exposed headland of the Great Orme

Nottingham catchfly *Silene nutans* Gludlys gogwyddol

Spring cinquefoil *Potentilla neumanniana*
Pumnalen y gwanwyn

neglected then the vegetation becomes more rank.

All of these grasslands support a suite of nationally scare plants that include spiked speedwell, hoary-rock rose, dark red helleborine, Nottingham catchfly, white horehound, spring cinquefoil and rare invertebrates such as silver-studded blue, silky wave moth and cistus forester moth. Populations of the UK Biodiversity Action Plan (BAP) priority species Juniper are present at several of the sites. The Great Orme is also home to the UK's only native cotoneaster, *Cotoneaster cambricus*.

The grasslands are included in the UK BAP lowland calcareous grassland Habitat Action Plan. Of the total Welsh resource of these grasslands the Conwy and Denbighshire CG1 grasslands represent 90%, the CG2 grasslands 75% and the ranker grasslands 66%. They are thus of national importance and their continued decline, if not reversed soon, is of major concern.

Livestock grazing on this difficult terrain with low productivity makes it economically unattractive and does not fit well with modern intensive farming. Currently many areas of grassland are in a downward spiral where what grazing that occurs becomes concentrated on smaller and smaller patches, thereby reducing its species diversity. As scrub of both native and non-native species advances, and to a lesser extent bracken, this will decrease the feasibility of grazing as the years go by.

In the last few years Plantlife has been trying to put together a programme that will restore the limestone grasslands and heathlands on the Orme and the recent acquisition of Parc Farm by the National Trust has added a new dimension. Working with partners in Conwy County Borough Council, BSBI, NRW, PONT, North Wales Wildlife Trust and the National Trust we will, hopefully, in the next few months have good news in taking conservation action on the ground and in engaging the visitors to this wonderful site to its wildlife as well as its history and views.

Colin Cheesman
Colin.Cheesman@plantlife.org.uk

Dark red helleborine *Epipactis atrorubens* Y galdrist ruddgoch

The Long Forest

We often take our countryside hedgerows for granted, but without this criss-cross patchwork of fields the landscape would look very different – impoverished from an aesthetic point of view, and bereft of wildlife. Hedgerows are quite rightly a priority habitat in the UK's Biodiversity Action Plan, important for the many rare species they shelter and for linking patches of woodland as 'wildlife corridors' that enable movement, migration and adaptation to change.

The oldest, most species-rich hedgerows might date back thousands of years and be the remains of the woodland from which fields were assarted (converted to arable use). Sinuous shapes reflect the ploughman's pathway as he brought the horse around to mark the next furrow. Arrow-straight hedges are more recently planted, mainly of 'quickset' – blackthorn, hawthorn and gorse – to create stockproof barriers as quickly as possible in pre-barbed wire days.

Traditional management styles range from coppicing for harvesting firewood and fodder to hedgelaying. This ancient art involves the periodic cutting of stems and laying them horizontally to the ground, connected to the roots by the merest sliver of intact, living cambium. This encourages vigorous regrowth and gives the hedgerow its unique, dense character. Styles of hedgelaying are diverse, kept alive by the handful of hardy souls who brave the winter to practice their art.

Benefits

Hedgerows stabilise soils and prevent erosion, capture pollution running off fields, and reduce exposure to wind. They are sources of fuel and food, and help reduce global warming by removing CO_2 from the atmosphere. Bursting from winter dormancy into a profusion of nectar-rich blossom, they attract buzzing insects and the nesting birds that feed upon them. In autumn many creatures depend on the banquet of berries and nuts to build the necessary reserves to overwinter. Hedgerows host over 130 priority species, including such rarities as hazel dormouse, greater horseshoe bat and purple emperor butterfly.

Yet despite all these benefits, hedgerows are in trouble. Around 120,000 km were ripped out before the mid-1990s to make way for ever larger fields and the agricultural equipment needed to tame them. Whilst that direct loss has since been stopped, around half of what remains is inappropriately managed. Neglected hedges grow into gappy lines of trees; when cut back too far they lose vigour and fail to support wildlife.

Getting hedgerow management right isn't difficult, but it does mean having to accept a little untidiness around the farm. As hedges grow taller and, importantly, wider, the overall benefits are far greater. Cutting need not be annual: at the very least, alternating which side of the hedge is cut allows the other side to produce vital blossom and fruit.

Hedge fund

The Long Forest Project, led by Keep Wales Tidy and funded by the Heritage Lottery Fund, hopes to foster a new level of enthusiasm for hedgerows and their management by working closely with local community groups, landowners, schools and businesses. The project aims to survey existing hedgerows and then to improve them through 'gapping up', reinstating traditional hedgelaying, and planting new hedgerows. Training is provided for both community groups and individuals, and trees are provided by the Woodland Trust.

Rory Francis

With a plethora of emerging tree diseases such as ash dieback, safeguarding our wonderful hedgerow network for the future is more important than ever. The loss of ash, both as full grown 'standards' and as shrubs within the hedge, could have a significant impact on the connectivity of the landscape, in turn affecting the ability of wildlife to respond and adapt to climate change.

Succession needs to happen now: trees take a long time to grow but can be killed off very quickly. We know there are some serious threats already affecting them, with others on the horizon. Dealing with these threats means acting quickly and at scale. The character of the landscape could change for ever: let's help make that change a positive one.

Nick Atkinson
Senior Advisor, Conservation and External Affairs, Woodland Trust.
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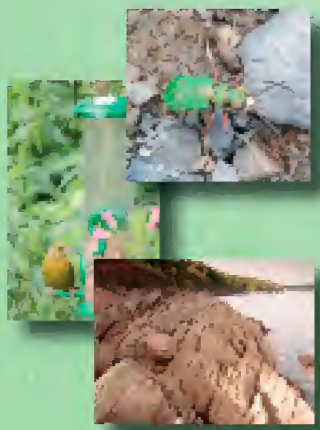
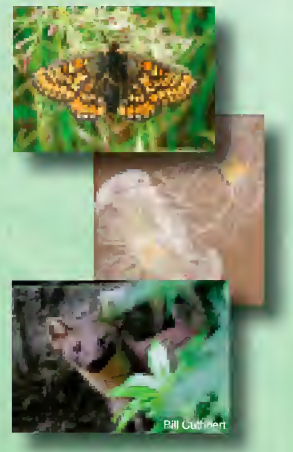
Cymru Anhysbys 2016 – Unknown Wales 2016

Diwrnod i ddathlu bywyd gwyllt Cymru
A day to celebrate Welsh wildlife



O bele'r coed i'r brenig cyffredin, bydd Cymru Anhysbys unwaith eto'n taflu goleuni ar rai o ryfeddodau natur anghyfarwydd Cymru. I gloi, pleser fydd gwrando ar yr Athro Mike Benton yn dod â darganfyddiad mawr y flwyddyn ddiwethaf yn fyw – y deinosor Cymreig newydd.

From the humble limpet to the charismatic pine marten, Unknown Wales once again offers an insight into the lesser known side of Wales' natural world. To wrap up we are delighted to welcome Professor Mike Benton who will bring last year's big discovery, the new Welsh dinosaur, back to life for us.



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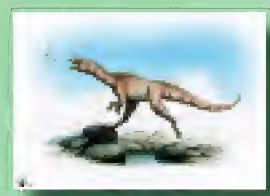

Sat 8th October 2016
National Museum Cardiff
Admission free.
T: 01656 724100 / info@welshwildlife.org to book; leave your details and number of places required.

A Wonderful World of Worms

A double diet of worms is coming to Wales. On June 18 a new exhibition Wriggle! The Wonderful World of Worms opens at the Amgueddfa Cymru–National Museum Wales in Cardiff. The exhibition features annelids – earthworms, marine bristleworms (polychaetes), leeches, crayfish worms – and many other kinds of worm. From fossils to fantasy, from spectacular beauty to fearsome predators, this free exhibition is suitable for all and runs until 30 September 2017.

Then, in the first week of August, Museum scientists host the 12th International Polychaete Conference. This is the first time this triennial event has been held in the United Kingdom and 150 experts from around 30 countries will meet in Cardiff to showcase the latest research on this important group of worms.

Amgueddfa Cymru-National Museum Wales

The ragworm, *Neanthes irrorata* from Sully Island, South Wales

For more information, see:
www.museumwales.ac.uk/cardiff/whatson/9051/Wriggle/
http://www.museumwales.ac.uk/ipc2016/

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